SCIENTIFIC AMERICAN

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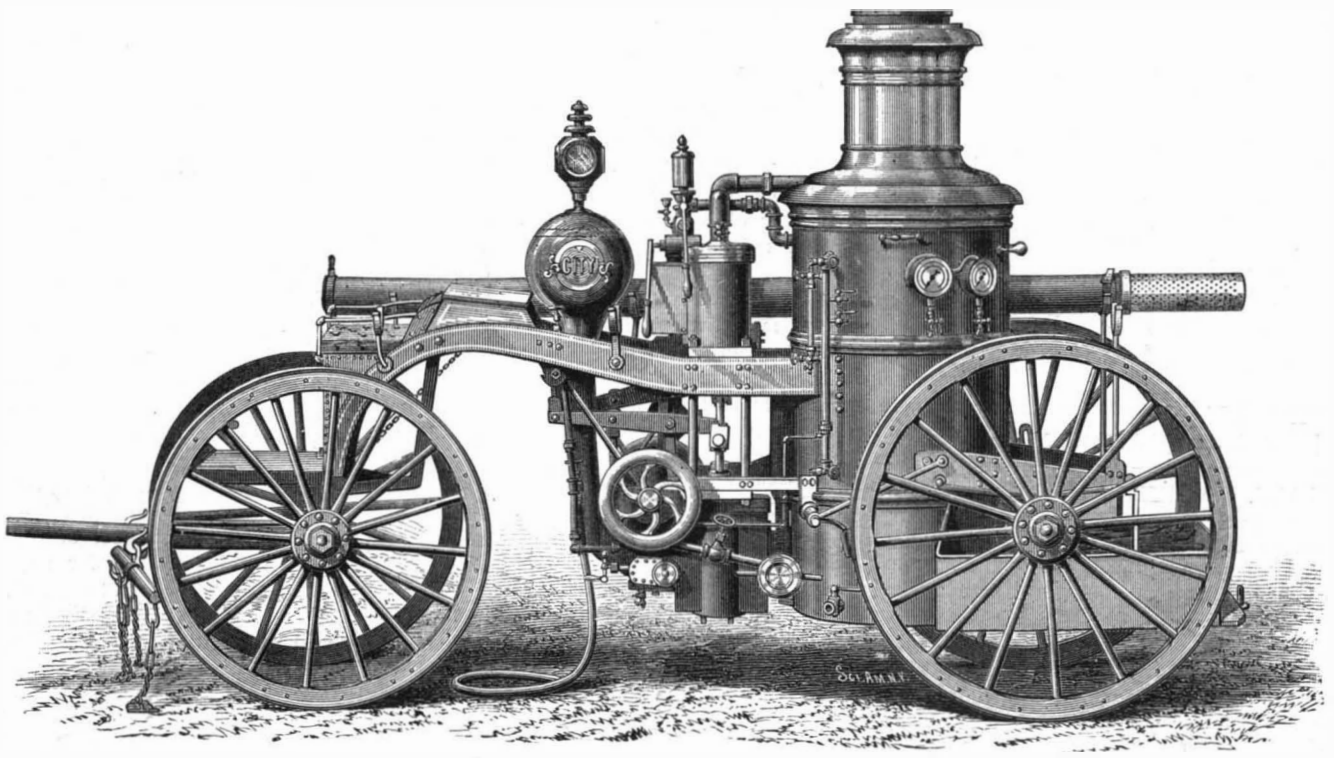
A NEW STEAM FIRE ENGINE.

In reciprocating piston steam fire engines of the ordinary construction, the common method of converting the reciprocating motion of the piston into a continuous rotary motion is to employ a slotted crosshead in which the crank pin revolves. This method is open to the serious objection of undue wear and a useless absorption of power. In the engine shown in the engraving, these objections are, in a great measure, if not wholly, overcome.

This engine, as will be seen from the engraving, somewhat resembles others now in use, but it differs from them especially in one particular, that is, in the manner of imparting motion to the flywheel shaft. The steam cylinder is placed directly over the water cylinder or pump, and their pistons are attached to opposite ends of a common piston rod, to the center of which, between the two cylinders, is attached a short crosshead, whose ends carry short connecting rods or links, which are pivoted to the end of a lever, or half walking beam, in the end of which there is a guide-hole through which the piston rod passes. This lever is pivoted at the other end to the frame of the engine, and between the piston rod and the middle of the lever is pivoted the main connecting rod, B, the lower end of which connects with this crank on the main or flywheel shaft.

By this construction a uniform and easy motion is secured, and much of the friction common to other forms is avoided.

This engine, which is known as the Moorlen Steam Fire Engine, was recently patented, through the Scientific American Patent Agency, by Messrs. Hiram H. Hill and Frank Moorlen, of Augusta, Me., from whom further information may be obtained.



THE MOORLEN STEAM FIRE ENGINE.

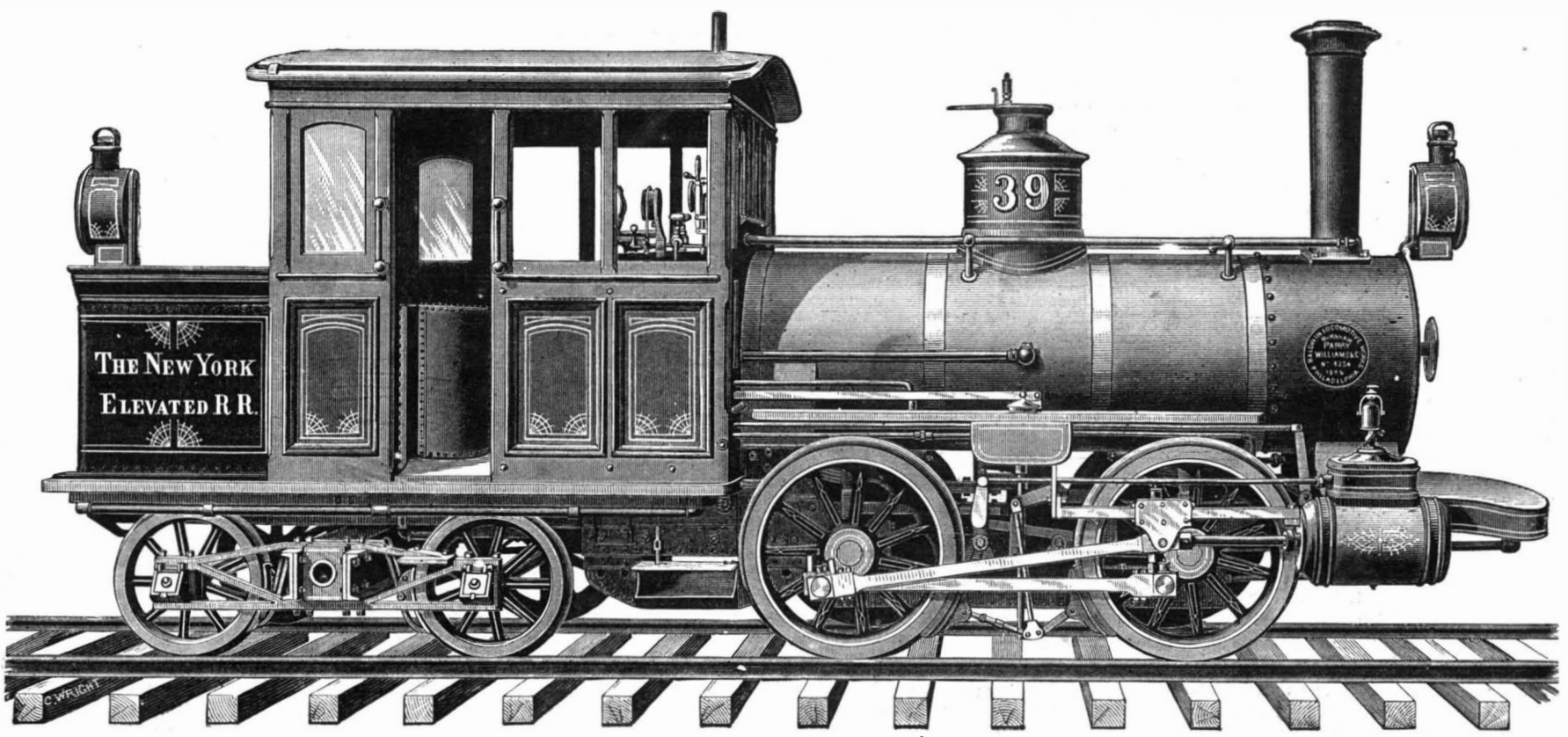
"FORNEY" LOCOMOTIVE FOR THE NEW YORK ELEVATED RAILROAD.

The larger of our title page engravings represents one of the eight-wheeled locomotives which are now at work on the east side or Third avenue line. This type of engine, which is known as the "Forney" locomotive, is now for the first time brought into extensive use, although several of them have been built and have worked satisfactorily.

The directors of the New York Elevated Railroad, after giving two orders, each equally divided between the four-wheeled and the eight-wheeled engines, have given a third order for twenty-five of the eight-wheeled, which may be interpreted as a decision in favor of the Forney locomotive. Thus far these locomotives have worked very successfully, as any one may see. The engines are run both ways, without turning around, and run over curves of 100 feet radius. The service is very severe, as the stations are only about a quarter of a mile apart, and therefore, to put the case in a Hibernian way, the running consists chiefly of stopping and starting.

The principal dimensions of the engines are as follows: Cylinders, 10 by 14 inches; driving wheels, 38 inches diameter; distance between centers of driving wheels, 5 feet 6 inches; total wheel base, 15 feet; length of fire box, 42 inches; width of fire box, 34 inches; inside diameter of boiler at smoke box, 34 inches, 105 tubes, 1½ inches diameter, 5 feet 10 inches long; height of chimney above rail, 10 feet 10½ inches; capacity of tank, 475 gallons; size of steam ports ¾ by 9 inches; size of exhaust ports, 1½ by 9 inches; lap of valve, ⅝ inch; maximum travel of valve, 3¾ inches; total weight of engine with full supply of water and fuel, 29,890 lbs.; weight on driving wheels, 19,170 lbs.; weight of engine without water or fuel, 23,380 lbs.

The engraving is made from a photograph of one of the engines built by the Baldwin Locomotive Works, of Philadelphia, but a portion of those now in use on the New York Elevated Railroad were built by the Rhode Island Locomotive Works, of Providence, from the same drawings.



"FORNEY" LOCOMOTIVE FOR THE NEW YORK ELEVATED RAILROAD.

ACCORDING to the *Pharmaceut. Centralhalle*, a serious accident in a factory led one of the owners to experiment as to the cheapest and best substances for making garments incombustible. He found that a 5 per cent solution of ammonium phosphate accomplished this purpose.

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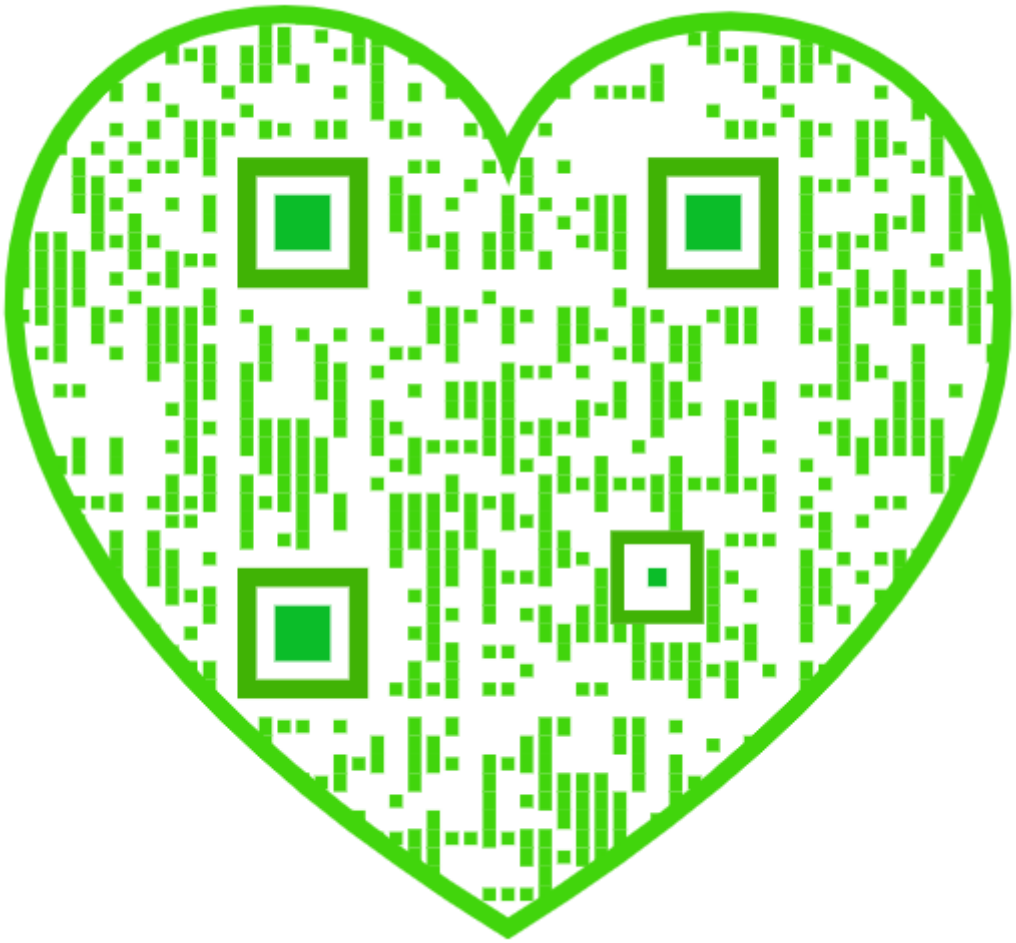

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NEW YORK, SATURDAY, NOVEMBER 23, 1878.

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A Chance for Electric Competition.

The Brazilian Minister, having received from his government authority to invite proposals for the illumination of the city of Rio Janeiro, will receive bids from citizens of the United States up to December 2, and they will be opened at Rio Janeiro on January 1, 1879. The contract with the British Gas Company, which now illuminates that city, will expire on March next. That company would dispose of all its material, buildings, and machinery for $2,651,756.

This would seem to offer an excellent opportunity for electric lighting companies to demonstrate their capacity on a grand scale. If they can do what they claim to be able to do, there should be no difficulty in their underbidding the gas men, with a wide margin for profit.

THE STEAM VALUE OF OIL FUELS.

Careful experiments made to ascertain the steam values of coal oils and petroleum have shown at times, when the combustion and all other conditions were perfect, results exceeding the theoretic efficiency of these fuels. In the experiments at Woolwich, a heavy oil, made from Boghead coal, that, theoretically, should convert into steam 17·5 lbs. of water per pound of oil, gave, as a maximum result, 17·8 lbs. of water converted into steam per pound of oil. Reasonably assuming that 12½ per cent of the actual heat generated was lost in radiation and in creating the draught in the chimney, we have the practical very far exceeding the theoretic efficiency.

With these fuels, which leave no residuum, complete combustion assures clean flues and boiler surface, the absence of any non-conducting deposit thereon to interfere with the best heat-transmitting conditions, and is an evidence also that the proportions of air and superheated steam are adjusted as correctly as practicable and thoroughly mixed with the oil vapors. Yet such conditions in themselves fail to account for an evaporation in excess of that due to the generally accepted value of the chemical combinations of the elements present.

By generally accepted value, we mean that estimated upon the known calorific power of carbon as contained in wood charcoal, which even now almost invariably forms the basis of calculations for determining the calorific power of carbon in any state.

But the often observed fact that the practical heating power of some coals and of the liquid hydrocarbons exceeds their estimated power, cannot be explained by the charcoal carbon rule, but only on the hypothesis that the different forms or conditions of carbon have each a value of their own, which can only be determined by actual experiment.

An eminent authority, Professor Henry Wurtz, who has studied, perhaps, more thoroughly than any one else, the phenomena of the combustion of liquid fuels, and whose conclusions have been indorsed by many other scientists, says, in explanation of these variations, that the heating effect of carbonaceous fuels "depends upon the density of the burning vapor and the concentration and intensity of the heat; that carbon, like everything else, has a latent heat of fusion or of liquidity, though the amount of this is as yet unknown, but it seems probable that it is large in amount. In case of oil fuel we are clearly dealing with liquid or fused carbon, which, according to this view, should yield us more effective heat for equal weights than solid carbon in coal. This has been overlooked in the accepted modes of estimating the calorific effectiveness of liquid fuels, and they must have been underestimated accordingly."

The rapidity of thermal action is due, in a great measure, it is well known, to the difference between the temperature of the radiant and that of the recipient, is greater at high than at low temperatures, and the effects are especially noticeable in boiler firing where there is a large difference between the two sides of the boiler plates. The transmission of heat not only increases with the difference between the temperatures, but is greater for each degree of difference.

In these facts we have an added explanation of the great advantages of intense and concentrated heat.

The values of these several points, for the correct determination of the heat efficiency of fuels, can be ascertained only by long and careful experiment; and to nothing of greater importance can the attention of metallurgists and engineers be turned.

Ignorance of these has, in many instances, led to the rejection or suppression of results of boiler experiments which indicated higher calorific power for the coal than theory permitted.

In one instance which we have in mind, a 48 hours' run was made with a boiler fired with pulverized Cumberland coal, and the average evaporation for the whole time was 15·164 lbs. of water from 212° Fah. per pound of coal. The fuel was reduced to an impalpable powder—almost equal to liquid carbon—and injected by a current of air into the heated fireplace; igniting instantly, it was perfectly consumed, giving a flame of great intensity and concentration; doing far better than the old law allowed, yet less, perhaps, than our progress in thermal science tells us should have been done.

The old formula must be revised to meet the issues presented by the new fuels and the improved methods of firing.

A NEW BANK NOTE PAPER WANTED.

The government has for some nine years been using for bank notes, etc., a paper made exclusively at the Glen Mills, near Philadelphia, the proprietors of which have derived a comfortable income from their exclusive contract. The Secretary of the Treasury came to the conclusion some time since that too much was being paid for the paper, and sent a committee to the mills to see if the paper could not be manufactured more cheaply and what the profit was to the company, but the committee were unable to make any suggestions on this head, as the company refused to divulge the cost of manufacture, etc. The prices now paid by the government are very high, from sixty to seventy cents a pound, according to the use to which it is put, the sixty cent paper being used for bank notes and the higher priced for bonds. In view of these facts the Secretary has determined to advertise for bids for supplying paper suitable for the purpose. The advertisement will call for a distinctive paper, and for a device or devices which can be placed upon the paper that may be used, and which if adopted will become the exclusive property of the government. The paper must be made from pure linen stock, the distinctive feature to be produced by the introduction of silk or other colored fibers. The paper will have to be manufactured under the supervision of the government, and if deemed necessary, under the protection of a guard stationed at the mill to prevent counterfeiters stealing it. The bids will be opened on December 4.

The Secretary has from time to time received specimens of new kinds of paper for which were claimed all the merits of the fiber paper and more besides. He now proposes to make a change, if an equally good and more economical paper is offered, and it would seem as if this was a chance for some of our inventors to get up some new and better paper than any heretofore made, and thus get a profitable contract from the government.

TRADE MARK TREATY WITH BRAZIL.

The Rio de Janeiro correspondent of the *Evening Post* reports that a convention between the United States and Brazil, for the reciprocal protection of trade marks, was signed September 24, and now awaits the formal ratification of the two governments. It is described as a simple, straightforward instrument, giving to the citizens of either country all the rights and privileges of the other in the matter of registering patents, brands or trade marks as a proof of ownership or agency, and of seeking legal redress whenever such rights and privileges are infringed upon.

At the outset, Minister Hilliard was prepared carefully to specify in the document itself what steps should be taken by either party to secure the desired results; but an examination of the Brazilian laws relating to this subject showed them to be so full and so satisfactory that any concession beyond the right of appealing to them was wholly unnecessary. Under these laws a registered trade mark is entitled to the same protection, and the proceedings and penalties for infringement are much the same as with us.

In view of the increasing trade of Brazil with this country, and the already large demand there for American goods, imitations of which are largely foisted upon those markets, it is incumbent on every manufacturer who cares to maintain his rights to avail himself of the protection which this treaty will secure.

THE TREATMENT OF HYDROPHOBIA.

Mr. Stanford, a member of the English Parliament, has offered a prize of £100 for an essay on hydrophobia, its nature, prevention, and treatment, and the British Minister at Washington has brought the matter to the attention of the Department of State, that the necessary publicity may be given to the offer in the United States. The prize is to be awarded by the Royal College of Physicians of London. The questions which are thought by the college to require special investigation are: The origin and history of outbreaks of rabies, particularly in the British dominions; the best mode of prevention of rabies; the characteristics of rabies during life, and the anatomical and chemical changes which are associated with the disease in its successive stages, particularly in its commencement; the origin of hydrophobia in man, and the chemical and anatomical morbid changes observed in the subjects of the disease, with special reference to those having their seat in the organs of the nervous system and in the salivary glands; the symptoms of the disease, particularly in its earlier stages, and the diagnosis of the disease in doubtful cases, from conditions more or less resembling it, together with the alleged prolonged latency of the disease and the efficacy of the various alleged remedies and modes of preventing it; and what plan of treatment, whether prophylactic or curative, it would be most desirable to recommended for future trial.

The conditions under which the prize is to be competed for are that the essay must be in English or have an English translation accompanying it, and be delivered to the college on or before January 1, 1880. The essay must be accompanied by a sealed envelope containing the name and address of the author and bearing a motto on the outside, the same motto to be inscribed on the essay, which may be the joint production of two or more authors. If not published by the author within a year, it is to become the property of the college.

THE MECHANICAL AND OTHER PROPERTIES OF IRON AND MILD STEEL.

All who have to handle iron and steel, or who are interested in the question as to the adaptability of steel for taking the place of iron in mechanical and civil engineering operations, will find in the last issue of the SCIENTIFIC AMERICAN SUPPLEMENT (No. 150) one of the most valuable papers on the behavior of these metals under critical tests that has appeared in a long time. The paper was read by Mr. Daniel Adamson, of Manchester, Eng., before the European Iron and Steel Institute, at its session in Paris, September 16, and it is illustrated by some sixty figures, exhibiting the effects of various strains upon irons and steels of varying composition and structure. It is also accompanied by a full page table showing the chemical composition of the metals tested, the dimensions of the specimens, and the results obtained by the various tests.

Mr. Adamson writes from the standpoint of the practical user of these metals, as well as an experimental investigator of their properties. His object has been not merely to go over the ground covered by previous investigations, to prove by experiment the tensile strength of iron and steel, but to supplement them by more comprehensive tests, in con.

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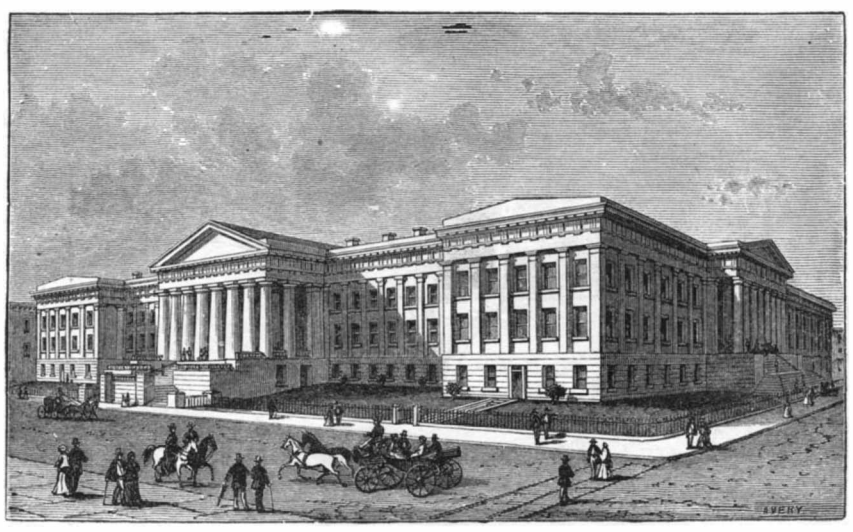
nection with a more complete record of qualitative and quantitative conditions. For example, the exact chemical composition of the metals tested has been noted, to determine the effect of cinder, sulphur, phosphorus, silicon, carbon, and other chemical and mechanical admixtures, under varying conditions of temperature and stress.

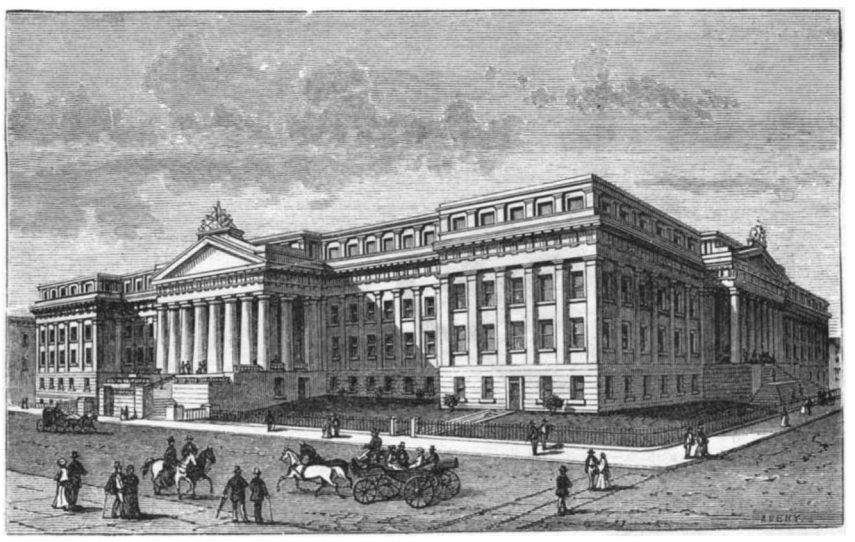
A special object was to determine the behavior of various irons and steels when subjected to concussive force, such as may be produced by the explosion of gun cotton, gunpowder, and other explosive materials, with a view to determine among other points the effect which an exploding boiler would have on another boiler working under pressure at its side, or the effect of a collision of one ship with another; and whether wrought iron or steel possesses the greater power to resist such accidentally produced strains. He also made and records many experiments on various irons and steels to discover the influence of composition, temperature, and so on, in varying the power of the metals to resist tensile tests; and the same with regard to chemical tests, as by corrosion. Altogether the paper must prove not only a standard work on the character and properties of iron and mild steel, but also have a marked effect in shaping the practices of mechanical and civil engineers in the manipulation and use of these metals.

THE PROPOSED ADDITION TO THE PATENT OFFICE.

The Patent Office building, at Washington, was originally one of the finest specimens of the Doric order of architecture in the country. Somewhat more than a year ago a fire destroyed a part of the upper portions of the west and north wings of the building. In view of the circumstance that the office has for some years been seriously cramped for room, it is now proposed to secure the additional space needed by adding an attic story to the entire building, instead of simply restoring the burnt portion to its original state, and providing for the enlarged needs of the office in some other way. The proposed attic story, in the plan adopted,



THE PATENT OFFICE AS IT IS.



THE PATENT OFFICE AS IT IS TO BE.

is raised on top of the old block course, and is about thirteen feet in height, without any variation all around the building.

The effect of the added story will be seen on comparing the two engravings herewith. However skillfully treated the addition must destroy the purity of the architectural type, and materially injure the general architectural effect of the building. This great sacrifice of art to utility would be justifiable on one condition only—that of absolute necessity. If there were no other way to provide the Patent Office with the room it needs, as many stories might be added as the original walls would support, the problem then being to make the alteration as little offensive to good taste as might be possible. But, as we believe, that exigency has not yet arisen, and is not likely soon to arise—provided the Patent Office is given its due in its own house. This handsome edifice was built for the Patent Office, its almost prophetic projectors having in view the vast requirements which the Office would ultimately have need of. Temporarily other governmental offices were sheltered under the same roof, the Patent Office having room to spare. By its natural growth, however, the Patent Office now needs the space thus surrendered, and ought to have it, the temporary tenants finding accommodation elsewhere.

This, then, is the true solution of the whole problem; give the Patent Office its own, or so much of it as it may require, only restored to its original state, and find lodgment for the dispossessed offices in a building of their own. The United States might better spend in this way a hundred times the money voted for the spoiling of the Patent Office edifice, rather than ruin the effect of such a fine piece of architecture by what, after all, must prove but a temporary makeshift.

TABLE FORKS.

We are often disposed to sneer at the Chinese mode of eating their food with chopsticks, and fancy they must make very dirty work at their meals, yet they are cleanly compared with the habits of our ancestors of two or three centuries since. At that time, even in the best society, forks were unknown, except among the Italians, who appear to have had them in general use considerably earlier than any other European nation, and are believed to be the inventors, or rather the originators, of the custom of using forks at the table. Forks, however, had long been used for raising meats out of pots or cooking vessels by the Greeks and Romans, and the use of forks for lifting the meat from the seething pots is recorded in the Bible. The Egyptian priests, also, in presenting offerings to the gods, used forks made of bronze, two of which, dug up at Sakkarah, are in the Abbott collection. None of these people, however, although familiar with the use of the fork in this manner, had any idea of using the fork at table. The mode of serving meat varies somewhat in different nations. In some countries the head of the house took the joint in one hand, and, with a knife held in the other, severed the meat into suitable pieces for each person. In other cases the joint was passed from hand to hand, each person cutting off sufficient for himself with his own knife, and then passing it to his neighbor, each cutting off such part as suited him. The portion thus cut off was afterward divided into smaller pieces suitable for eating, and conveyed to the mouth by the fingers of the hand unoccupied by the knife.

In many parts of Spain, to this day, table forks are unknown articles. In many taverns in other parts of Europe, knives are not placed on the table, because it is expected that each traveler is provided with his own, but as few persons will now eat without forks, landlords are obliged to furnish these, together with plates and spoons. It is curious that although the use of forks has not yet spread all over Europe, yet the savage Feejee Islanders have long had table forks in use. At a time when almost all of Northern Europe was destitute of the article, these people, the most cruel and most ingenious of all the natives of Polynesia, used forks in conveying to their mouths dainty morsels of *puakabalava* (long pig), as they called cooked man.

None of the sovereigns of England had forks till the reign of Henry VIII., all, high and low, using their fingers. Queen Elizabeth had several forks presented to her, and although she was seen to use them on state occasions it is doubted if she used them ordinarily.

Voltaire states that table forks were first used by the Lombards in the fourteenth century, and Martins says that they were in common use in Italy in the fifteenth century. Coryat, in his "Crudities," published in 1611, states that he observed a custom in all Italian cities through which he passed that he had seen nowhere else in all his travels. "The Italians, and also most strangers that are cormorant in Italy, doe alwaies at their meales vse a little fork when they cut their meat." Heylin, in his "Cosmograph" (1662), says: "The use of silver forks, which is by some of our spruce gallants taken up of late, came from China into Italy, and thence into England." Another writer states that at the period of the revolution (1688) few English noblemen had more than a dozen forks of silver, along with a few of iron or steel. But after this steel forks became an article of manufacture at Sheffield, and they came into general use, having, however, only two prongs, and it was only in later times that the three pronged kind were used. These were originally forged and filed to shape slowly by hand, but in the present mode of manufacture, after the tang, shoulder, and shank are formed, a portion is flattened for the prongs, which is then struck up into form by a swage drop, leaving only a thin film between the tines, which is cleared away by the file. These processes are followed by hardening, tempering, grinding, and polishing, and securing the handles.

Although silver forks have long been in use to some extent, it was not until of late years that their use became in anywise common, as very few, even among the wealthy, used them until about fifty or sixty years ago, and the steel ones are still very largely used among the poor.

Many patents have been granted of late years on forks of various kinds, over a dozen being for means of combining the "finger guard" on carving forks with a "rest," so that the raising of the former will lower the latter. In addition to these we find many patents granted for various improvements relating to ordinary dinner forks. One granted to F. C. Beach, December 5, 1865, shows a fork provided with a simple device for sharpening a knife; and the same gentleman, in connection with A. C. Klancke, obtained another patent September 4, 1866, for making the handles of knives and forks hollow, so as to form a pepper box, the sprinkler being provided with a valve so as to shut off the supply when not needed. C. A. Durgin's patent of May 8, 1866, shows a fork having the two inner tines dropped below the outer ones, so as to make a kind of spoon, for taking up peas or other small articles. J. S. Jennings' patent of September 11, 1866, shows a fork having pivoted to it a swinging knife, the two being so connected as to be readily used by a one-handed person, as the swinging knife may be readily operated by a single finger of the hand holding the fork. A combined knife, spoon, and fork, in one instrument, is shown in the patent of N. Ames, September 17, 1871, a spoon being formed on the end of the back of the knife, and the point of the spoon terminating in short tines. The patent of S. W. Francis, February 3, 1874, and C. Reese, April 23, 1878, both show spoons, having cutting edges at the sides of the bowl and tines at the point, thus combining a spoon, knife, and fork in one implement. A very elegant fork was patented by J. C. Draper, February 18, 1873, which was designed to be used in eating fruit, and is provided with a small bowl at the junction of the tines to catch the juice of the fruit. Another peculiar fork is shown in F. M. Dixon's patent of February 13, 1877, designed to be used for holding green corn in the ear, and has a long central tine to pierce the cob, and a short one on each side intended to enter the cob just sufficient to prevent its turning.

A YEAR'S WORK IN THE PATENT OFFICE.

The report of the operations of the Patent Office during the fiscal year ending June, 1878, shows no abatement of the inventive spirit of the American people. The number of original applications for patents was 19,657, and 14,100 new patents were granted. There were also 627 reissues and 722 patents granted for designs. Twenty-seven hundred and thirty-seven caveats were filed during the year. The receipts of the office amounted to $734,888, and the total expenditures were $665,906. Of the amount expended, however, $50,000 was for the restoration of 18,563 models injured by the fire of last year, and, omitting this item, the excess of receipts over expenses appears to have been $118,982.

The number of trade marks registered was 1,505, as against only 938 for the preceding year, and the receipts from this source and from the registration of 492 labels, amounted to $42,762, a sum eight times greater than the total expenses of conducting the division.

NEW RULE IN TRADE MARK CASES.

Commissioner Paine of the Patent Office has lately adopted a new and very excellent rule in trade mark cases, which consists in dividing the payment of the government fees, so as to lessen the expense of applying for registrations.

The government charges for every trade mark registration are twenty-five dollars, and heretofore the rules of the Patent Office have required the payment of the whole amount in advance, before the examination of the case. If on the examination it was found that the proposed trade mark was old, or if for any other reason the case was rejected, then the applicant was obliged to lose the whole of the fee paid.

By the new rule now promulgated by Commissioner Paine, the applicant pays only ten dollars in advance. If the case is rejected he has no more to pay; but if registration is allowed he then pays the balance, fifteen dollars.

The new rule will promote public convenience and have the effect to increase the number of applications for registration. Full particulars how to apply for trade mark registration, expenses, etc., will be found in the "Scientific American Hand Book," which may be had at this office by all who choose to send for it, free of charge.

Electric Light in Chancery.

Recently an interim injunction was obtained against Messrs. Wells, of Shoreditch, restraining them from continuing the use of the system of electric lighting, the apparatus of which is shown in one of our engravings this week. The applicant, Mr. Wild, claims that the Jablochkoff system, which is the property of a French company, is virtually the same as that invented by himself, and for which he took out a patent in 1863.

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FRENCH WHEELBARROWS.

If a man should arrive in France with but limited respect for wheelbarrows, he would be certainly in the way of conversion from the error of his ways.

Throughout the land things go on two wheels, and the voitures and omnibuses of Paris—all four wheeled—are but a small percentage of the totality. The predominance of the two wheeled is not alone with the wheelbarrows, but most of the heavy as well as the light hauling is done in carts of various kinds.

It is in wheelbarrows, however, that I am at present interested, and I think our mechanics may see something to admire and perhaps copy. Where shall we begin? With the skeleton. That is a fair foundation or frame for the subject. The different figures will require but little besides the names and purposes for sufficient explication.

Figs. 1, 2, and 3 are made by Paupier, are all of iron, and are sold for 1fr. 10c. per kilo, about 10 cents per pound avoirdupois.

Figures 6 to 9, inclusive, are of iron, are made by Paupier, and sold at the same price as the skeleton barrows, 10 cents per pound.

Figs. 10 to 24 will be easily understood from the descriptions which accompany the different forms, and in some cases the prices also are given.

Of Fig. 25 it need only be said that the inventor, while abstractedly considering his carboy support, soliloquizes thus:

"It only needs handles and wheels to make a wheelbarrow of it—I think, I think I must add them."

That would make a quarter century of wheelbarrows.

EDWARD H. KNIGHT.

Steam Street Cars.

In Paris very considerable experience has been acquired concerning the use of steam on tramways. Mr. Brown, of Winterthur, made an arrangement with a Paris company last summer, and engines which he has constructed are working daily from the Arc de Triomphe to Courbevoie, a distance of two and one sixth miles. Seventeen are employed, eleven being in use at one time. They begin to work at 4 P. M., and run till late at night. They usually haul two large tram cars, but on occasion they easily take three cars.

We have recently investigated the working of these engines, says the *Engineer*, and we can say that they are completely successful in a mechanical sense. How far they will be successful in a commercial sense is quite another matter, concerning which sufficient data do not at present exist to enable any decisive opinion to be expressed.

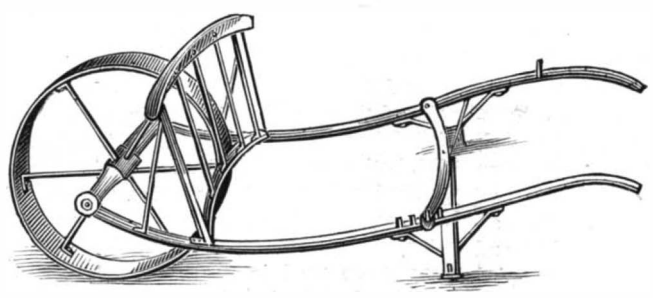

Fig. 1.—Wheelbarrow for Carboys.

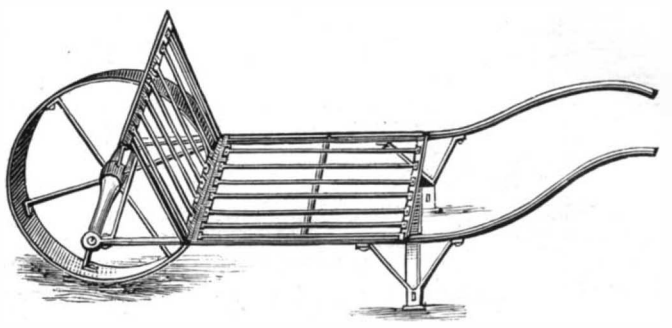

Fig. 2.—Skeleton bed Wheelbarrow.

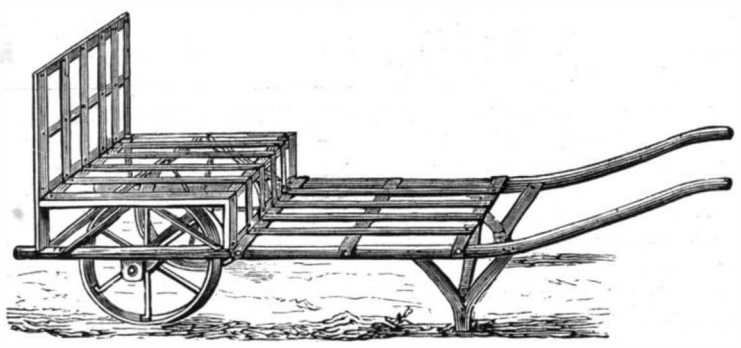

Fig. 3.—Wheelbarrow for Baggage.

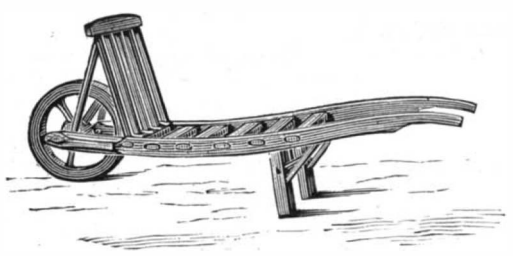

Fig. 4.—Wooden Wheelbarrow.

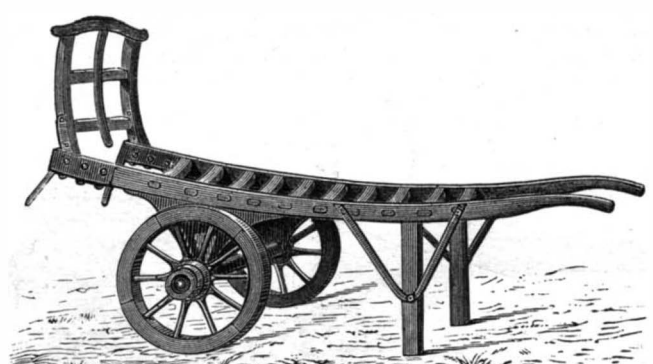

Fig. 5.—Wheelbarrow for Railway Stations.—(Model of Orleans.)

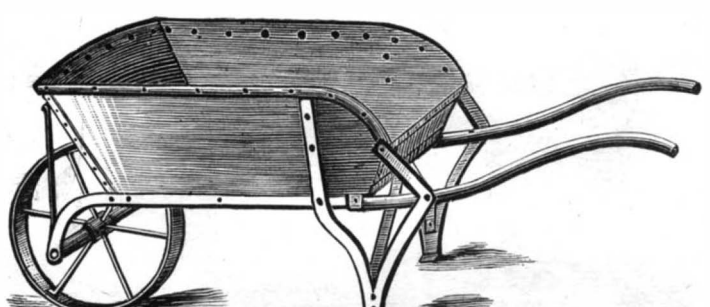

Fig. 6.—Garden Wheelbarrow.

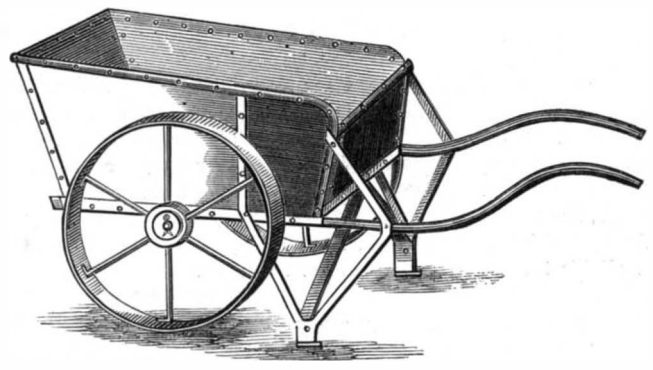

Fig. 7.—Large Box Barrow with two Wheels.

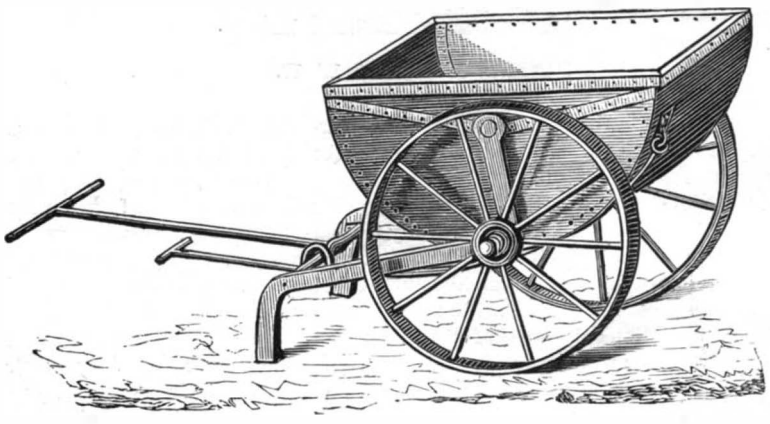

Fig. 8.—Coke Barrow.

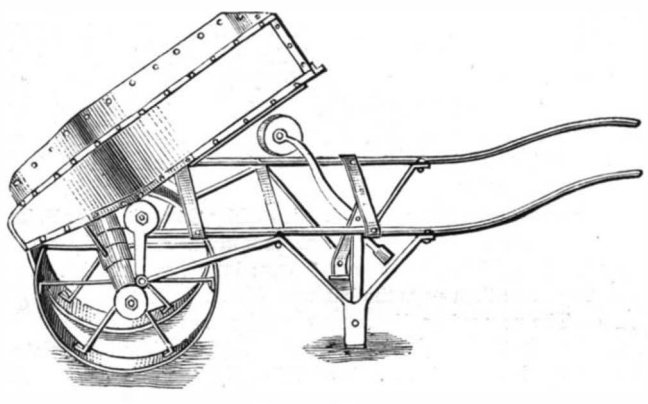

Fig. 9.—Dumping Barrow.

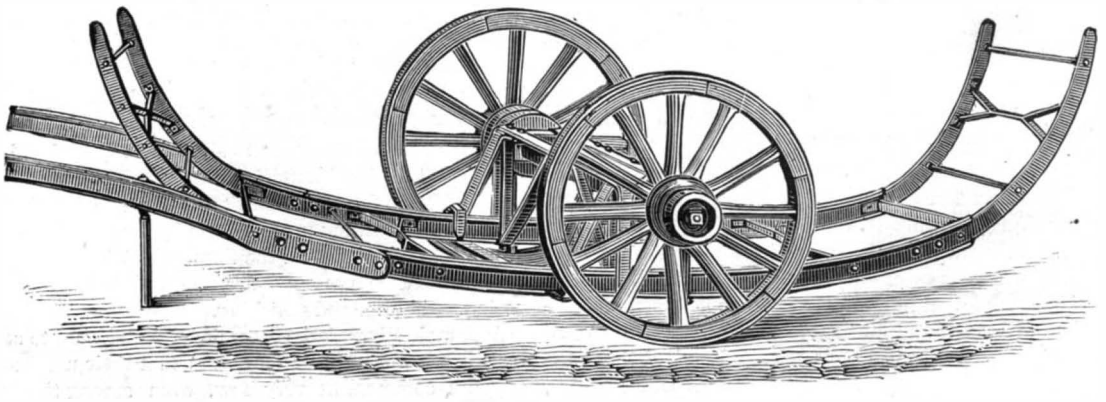

Fig. 10.—Truck for Wood.

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The line falls for a distance of something over a mile from the Arc de Triomphe; a portion of the gradient is, possibly, as steep as 1 in 50; the remainder of the road is nearly level. The tram cars on this route are horsed by a distinct company, and it is this company, and not the owners of the road, who are trying Mr. Brown's engines. The steam cars take their places and work precisely as the horse cars do, and their speed is consequently in some respects restricted. We find, however, that the run to and from Courbevoie is made in fifteen minutes, including all stops to take up and put down passengers, or at the rate of eight and two thirds miles an hour. A speed of about sixteen miles an hour can be readily maintained with two fully loaded cars. The average speed of the horse car, including stops, is not more than five miles per hour. As regards trouble from horses, our experience corroborates that of the engine drivers, who are all picked men, and very intelligent. It is that the horses take no more notice of the steam tram cars than they do of the horse tram cars, that is to say, no notice at all. The engines are perfectly under control. On one occasion, when riding on one of the engines on the run to Courbevoie, the road being clear and a speed of nearly twenty miles having been attained, a man coolly drove a horse and cart across the track within a few yards of the engine. The tram pulled up, however, within two lengths of the engine. After such an experience we have no hesitation in saying that the traffic can be worked as safely with engines as with horses, even at a much higher speed.

There are elements of success about the Brown tramway engine which deserve particular attention. To keep the mechanism out of the dirt, the cylinders and valve gear are placed above the level of the foot plate, and motion is communicated to the wheels by vertical rocking beams, one on each side. In this way the piston rods and slide bars can be kept free of mud and road grit. Various attempts to attain the same end have been made by other persons, but little or nothing was gained by the elevation of the cylinders while the eccentrics were close to the road. Mr. Brown has succeeded in dispensing with the use of eccentrics altogether, and the very peculiar and simple valve gear he employs instead works like a charm, and is exactly the thing for the required purpose. There is little or nothing about it to wear out or to keep in order. Another excellent feature is the boiler, which, considering its size, contains a very large quantity of water. The pressure carried is very great, 180 lbs. to 195 lbs. on the square inch, and the consequence is, that in obedience to a well known law, much power is stored up in the water. In fact, Mr. Brown's locomotive approximates in this respect to Lamm's fireless engine, and we have no doubt that he could make a run from Courbevoie to Paris without any fire whatever if steam were once up. The large quantity of water and the high pressure combine to equalize the demands made on the furnace, which requires no forcing. The fuel used is coke, which is carried in small bags on the engine. When the furnace requires to be fed, a scoop is fixed in the fire door, and one of the bags emptied into it; the scoop is withdrawn, and the fire door closed. On the run to Courbevoie the steam pressure does not fall at all; on the return trip, which is up hill for half the way, the pressure falls from 180 lbs. to about 165 lbs. The safety valves never blow-off, being, we believe, loaded to about 200 lbs. on the square inch.

As to the cost of repairs, we are unable, as we have explained, to speak positively. We understand that they are much smaller than any other type of engine used on the Continent. One engine, at all events, has worked for about eight hours every day for six weeks without any repairs whatever, a wonderful performance for a tram car engine; and save that a few nuts wanted screwing up and locking in their places, it was in excellent working order when we saw it. The road traversed is in places very bad indeed, and the engines jump in a way to seriously try their springs. The consumption of fuel and of oil is very small, and all things considered, we are disposed to think that Mr. Brown has gone at least as near as any other man to solving a very interesting problem. That the public appreciate his efforts is proved by the numbers who travel by the steam worked cars.

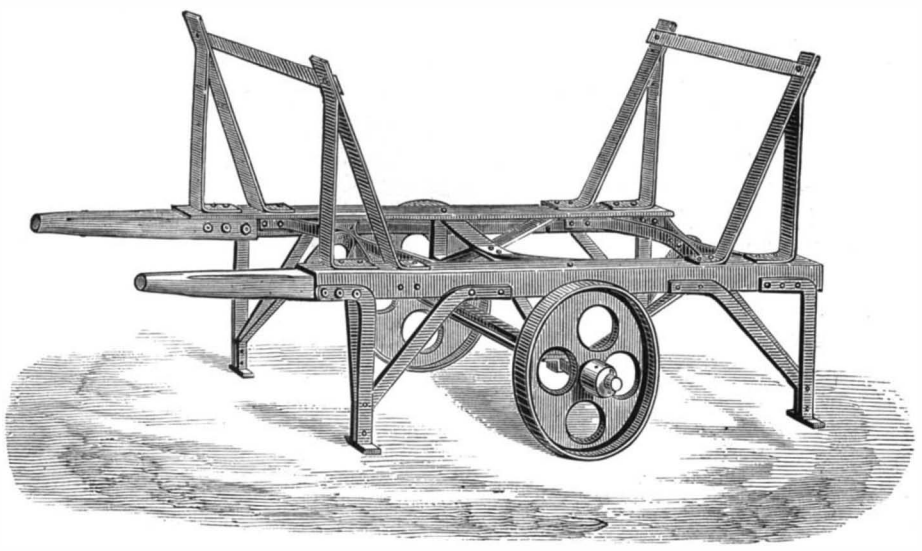

Fig. 11.—Truck for Pig Iron.

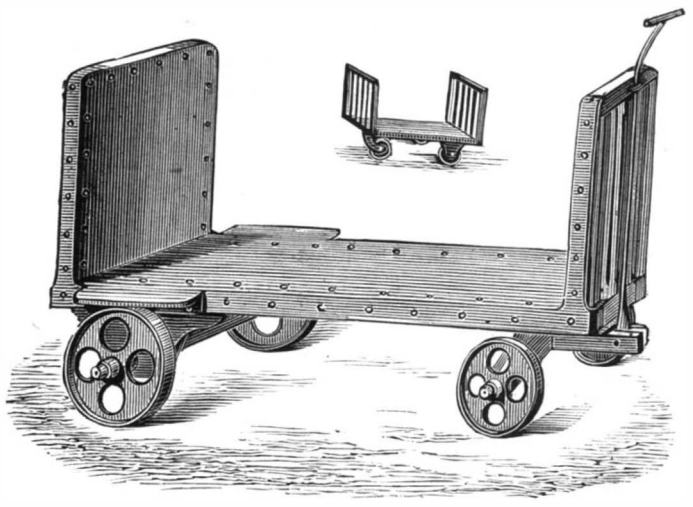

Fig. 12.—Baggage Truck. (Eastern Railway.)

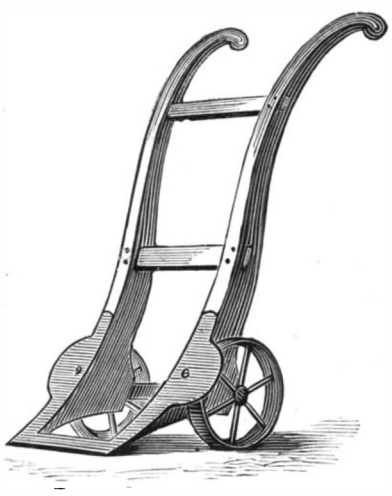

Fig. 13.—Sack Truck. Weight 34 lbs. Price $4.

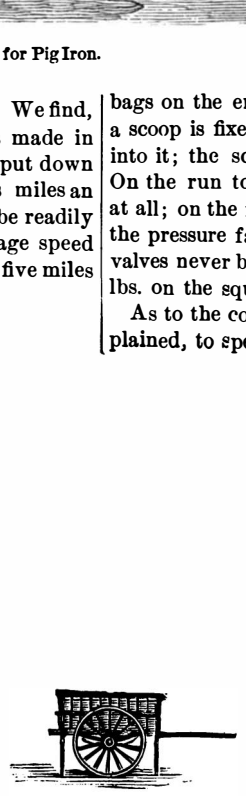

Fig. 15.—Truck for Stores.

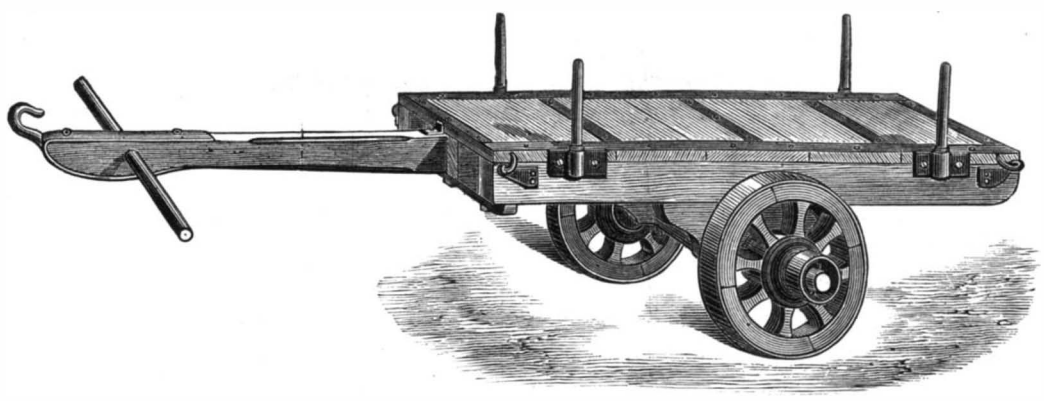

Fig. 16.—Low Truck for Hauling Stone.

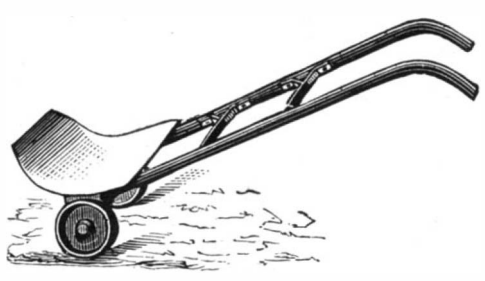

Fig. 14.—Bloom Truck. Iron, 10 cents per pound. Wood, 22 to 28 francs.

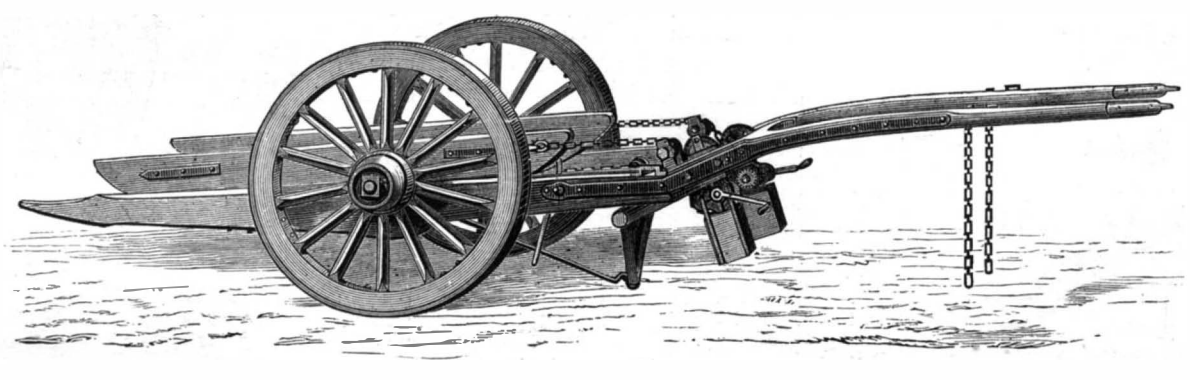

Fig. 17.—Dray with Windlass for Hauling Stone.

Butter Manufacture in Denmark and Sweden.

At a dairy show recently held in London the subject of butter manufacture in different countries was discussed. Mr. R. Warrington, an able writer on agricultural subjects, tells how the butter makers of Denmark and Sweden produce such excellent quality. Their plan, he states, is to cool the milk as quickly as possible immediately after it is received at the dairy. This is effected by means of cold water or ice. The latter is far more effective than water, and admits of constant results being obtained at all seasons of the year, and, in general, cold water is only employed as a partial substitute.

In either case the milk is set in cylindrical pails, the depth of the milk in the pail being about 16 inches, and the most improved form of pail contains about 35 lbs. of milk. The object of making the pail narrow is to facilitate the rapid cooling of the milk. The pails are set in a tank sunk level with the floor, and rest on narrow rafters of wood, so that they do not touch the bottom of the tank, and the water can thus circulate completely round the pails. It has been ascertained that 100 lbs. of milk in a metal pail 14 inches wide, the height of the milk being 16 inches, cooled from 93° to 54° in half an hour; in two hours to 48°; in four hours to 43°; and in ten hours to 36°. The cream is obtained by two skimmings at 24 and 36 hours from the time of setting, and where ice is used the cream is all obtained in 12 to 24 hours. In order to obtain the best quality of butter it is necessary to churn the cream as soon as possible after skimming. When there is not sufficient cream to fill the churn some new milk is added; and the addition of new milk to the cream is generally recommended as improving the flavor of the butter. Sweet cream butter is better and keeps better than sour cream butter, but people accustomed to the flavor of butter made from sour cream are apt to think butter made from sweet cream insipid, so that, in order to suit certain markets, the cream is sometimes soured before churning.

The process of souring is carefully regulated, so as not to exceed the wished for point. When the temperature of the cream is under 60°, souring takes place very slowly, but becomes rapid at a somewhat higher temperature. The cream is warmed, if necessary, by placing it in a metal pail standing in warm water, or by stirring the cream in the tub with a hollow metal stirrer filled with hot water. When the thermometer shows that the cream has reached the desired temperature, a little buttermilk is added to start the fermentation, and the operation of churning commences.

Souring should be so managed that the cream is just ready at the hour of churning, and if the souring proceeds too rapidly, it must be checked by cooling the cream.

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The higher the temperature of the cream, the quicker the butter comes, but butter churned at too high a temperature will be more or less greasy in appearance, and the same result is obtained when churning is continued for some time after the butter has come, or after the butter is too much worked while being made up after churning. On the other hand, butter churned at too low a temperature will be long in coming, and the product will be hard. It is impossible, however, to fix on any one temperature as the best, since the nature of butter fat varies somewhat at different seasons of the year, and according to the diet of the cow. Generally speaking, sweet cream should be put into the churn at from 50° to 55°, and sour cream from 52° upwards.

Forty minutes is about the time of churning which yields the best quality of butter, but thin cream requires longer churning than thick cream. It is indispensable for uniformity of work that the churn should always be turned at the same speed. The greater the speed the shorter is the time of churning, and in a wide churn a slow speed has the same effect as a higher speed in a narrow churn. The number of revolutions is easily ascertained by attaching a short piece of string to the spindle of the churn and counting how often it comes round in a quarter of a minute. The churning should be stopped as soon as the butter appears, as overchurning injures the quality of the butter. When the butter is taken out of the churn it is pressed lightly together by hand. Sweet cream butter is never washed; sour cream butter is slightly washed in some dairies, but this is not general. Color is artificially given to butter by mixing some "butter color" with the cream when it is put into the churn.

The retention of some buttermilk is believed to be necessary in order to preserve the "grain." After standing for an hour to harden, the butter is put through a machine for expressing buttermilk; care being taken not to overwork the butter, which would render it dry. The butter is next weighed, and after standing a couple of hours is again passed through the machine. Salt, at the rate of 3 lbs. to the 100 lbs., is added to the butter while going through the machine either at the first or second time of rolling. The butter when made is immediately packed into casks, the sides of which are slightly salted. Large quantities of sweet cream butter are exported from Denmark in tins to tropical countries, and it is stated that the great care taken to preserve the "grain" of the butter has the effect of raising its melting point, so that such butter remains solid in a hot climate.

The system described by Mr. Warrington, says the *Irish Farmer's Gazette*, is considered by him to have so many advantages that it will undoubtedly become the method of the future. It is being largely adopted in the United States, and is under trial in several parts of Europe.

Fig. 18.—Bruel's Tub Barrow. Wooden barrel, 50 francs

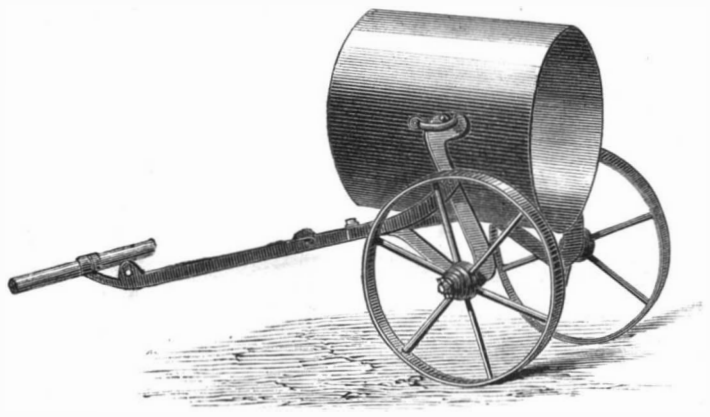

Fig. 19.—Bruel's Tub Barrow. Iron barrel. 65 francs

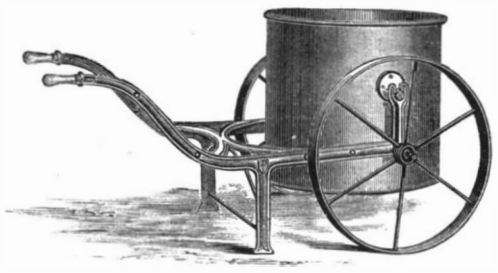

Fig. 20.—Waite, Burnell & Co.'s Swinging Tub Barrow. Capacities 82 to 225 liters. Price 75 to 180 francs.

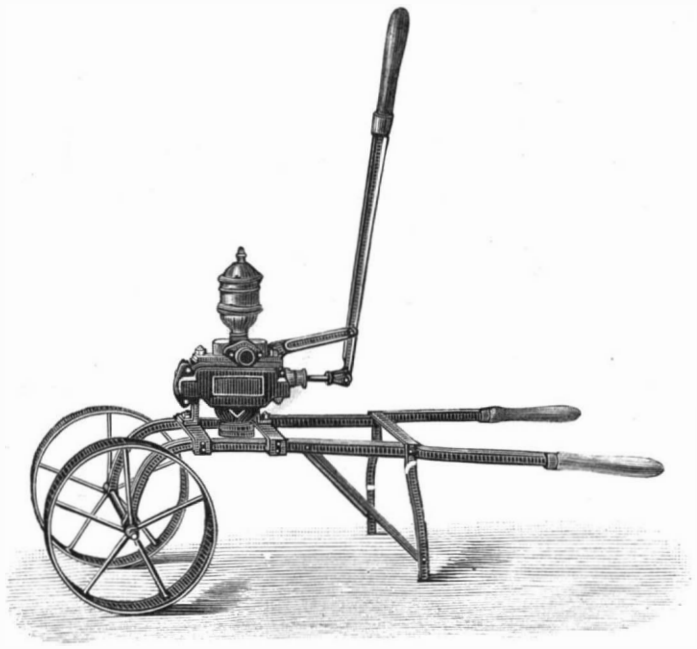

Fig. 21.—Beame's Pump Barrow. Horizontal Action. Capacity 2,500 liters per hour. Complete with Suction and Discharge Pipes, etc. 126 francs. Capacity 5,000 to 6,000 liters per hour, 213 francs.

Fig. 22.—Garden Pump or Barrow. Vertical Action. Price complete 115. francs.

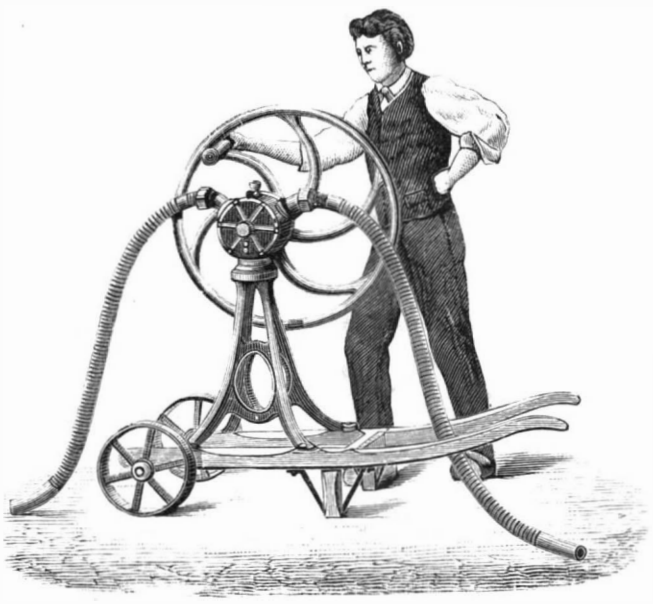

Fig. 23.—Rotary Garden Pump. Capacity 2,000 to 9,000 liters per hour. In bronze from 195 to 420 francs.

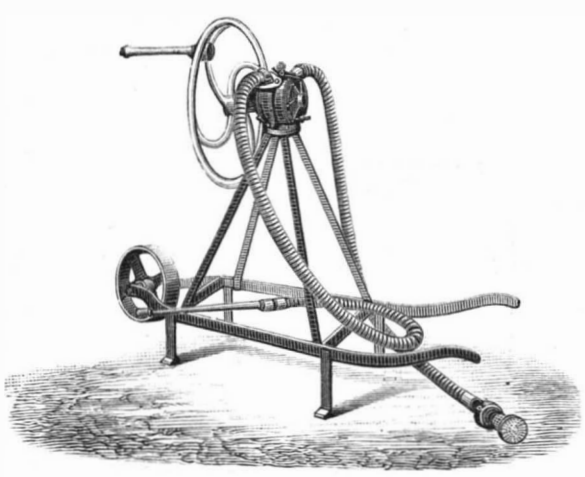

Fig. 24.—Rotary Pump on Iron Frame. Capacity 2,000 to 3,000 liters. Price 160 to 240 francs.

Lyman's Trigonometer.

Referring to the engraving of Lyman's trigonometer, published in our issue of November 2, we would state that Messrs. Heller & Brightly, 33 North Seventh street, Philadelphia, are the manufacturers, who supply the instrument.

The Black Spot on Jupiter.

In reply to the question of Mr. Eadie (SCIENTIFIC AMERICAN, October 26), as to the cause of the black spot observed by him on the disk of Jupiter, September 28, Mr. R. D. Schimpff writes that it was unquestionably the shadow of one of Jupiter's moons. The satellite had completed its transit, but its position was such that its shadow still rested on the planet at the hour named.

Fig. 25.—Carboy Support

New Agricultural Inventions.

An improved Plow, adapted to the various kinds of work necessary in the cultivation of cotton and other crops, has been patented by Mr. Benjamin H. Cross, of Cabaniss, Ga.

An improvement in Stump Pullers has been patented by Mr. William A. Webb, of Wadley, Ga. This invention consists in two supports, having notches formed in their upper ends, and a cylinder provided with journals upon its ends, and having a mortise formed in it for receiving the operating lever. A chain is connected with the cylinder and attached to the stump. When the cylinder is turned by means of the hand lever a great leverage is secured.

An improved Dumping Car has been devised by Mr. Louis Prince, of Nashville, Ohio. This invention applies to the cars, or to a detachable frame resting thereon, a truck or wheeled false platform, which is capable of being shifted laterally, and has a series of tilting floor sections or traps, on which the freight is deposited; there are also hinged to the sides of the cars, or to the detachable frame resting thereon, a series of cranes, which may be swung laterally when required to support the trucks while discharging their freight. The freight is loaded on the flat floors of the said truck or false platform in the usual manner, and when the cars arrive at their destination each truck is shifted or moved laterally on the cranes, until all or a part of its pivoted floor sections overhang the side or are clear of the car, when said sections are tilted and the freight discharged.

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Correspondence.

Small Steamboats.

To the Editor of the Scientific American:

I have taken your valuable paper for some years, and the accounts of small steamers and answers in the correspondent column have interested me a good deal, as it is in my line.

There is one thing in which I think you make a mistake, and that is in advising people to use vertical boilers for steam launches. I have tried both vertical and horizontal in the same boat, and find the latter superior in many respects. The vertical boiler gets steam up to 80 lbs. pressure on the square inch in three quarters of an hour, but when the engine was running, even slowly, it primed so bad that we could never tell how the water stood without stopping altogether, as the gauge glass looked as if it was full of soap bubbles; when we stopped at a wharf the steam would rise at a fearful rate, even with the fire almost out and the door open. I have seen it go up from 40 lbs. to 90 in less than five minutes.

The horizontal boiler takes about two hours to get 60 lbs. from cold water, but when running the water does not stand more than ½ inch higher in the glass than when standing, and never foams at all. Another advantage which this boiler has over the vertical one is that it stands much lower in the boat, the top of the dome being level with the gunwale, whereas the vertical stood some 18 inches above, which made the boat very crank and hardly safe in a sea.

The engine was built by my brother and myself, most of it of an evening after we were home from work and on holidays; we made our own drawings and patterns, and had the casting and forgings done at the foundry.

The cylinder is 4½ inches diameter, with 5 inch stroke of piston, cutting off at ¾ stroke; pump ⅝ inch diameter by 5 inches stroke. We usually ran her at 300 or 400 revolutions a minute with 75 lbs. steam. The boiler is horizontal, 2 feet 6 inches diameter and 3 feet long, 4 feet over all, with a 6 inch smoke box at each end; there is a flue right through the boiler, 15 inches diameter, and return tubes which are also 3 feet long, 1¾ inch outside diameter. There are 18 tubes, but the boiler would have been better if there were 6 more. The boat is wood, diagonal built, 24 feet keel, 26 feet 5 inches over all, 5 feet 8 inches beam over bead, 3 feet 9 inches deep; built with very fine lines both fore and aft.

The propeller is 2 feet diameter and 3 feet pitch. With a 4 bladed propeller, 3 feet pitch, we ran the measured mile (6,080 feet) with tide, carrying 80 lbs. steam, in ten minutes. Not being satisfied with this performance, we cut two blades off, when, with 2 bladed propeller, 3 feet pitch, we ran the same distance, with the same pressure, in slack water, in 8 minutes and 40 seconds. In this case the tide had just turned and was slightly against us.

We also tried a three bladed propeller, 2 feet diameter, 2 feet 10 inches pitch, when she ran the mile in 8 minutes and 55 seconds with the tide, carrying 75 lbs. steam. From the above it will be seen that the 2 bladed screw gave the best results. S. FIRTH.

Auckland, N. Z.

[It is scarcely fair to condemn the vertical boiler, in general, on account of the bad performance of a single specimen. It is true that each form has some special advantages, but one can be made to furnish as dry steam as the other, when properly proportioned. We are glad to receive the account of your boat, which will be of interest and value to many readers.—ED.]

Life Preservers.

To the Editor of the Scientific American:

The loss of life at sea, and the river accidents of almost daily occurrence, should stimulate inventors to produce some simple life-saving apparatus. The difficulty is to set the inventive fashion in this direction; and as everybody's business is usually nobody's business, there is no interest in this matter except at the time of an accident, or during the nine days' wonder excited by a calamity. Most of our steamers and sailing vessels are supplied with circular buoys, air cushions, and cork life preservers, but at the moment of collision or upset these articles are not accessible, or are with difficulty attached to the person. The suggestion of a "circlet of waterproof cells," in a recent article in the SCIENTIFIC AMERICAN, is a move in the right direction. Some modification of Boyton's swimming gear, or of Cleburne's air hammock, might be made simple, cheap, and portable. After the Huron disaster, Medical Director Cleburne, of the Navy, suggested the use of "air-tight waterproof hammocks" for seamen (made of light, flexible, impervious material, free from the objectionable features of rubber cloth), so that in case of shipwreck each man would be provided with a life-saving apparatus capable of supporting in the water three to four hundred pounds, and by a simple arrangement a number of these beds could be attached together to form a life raft capable of saving the entire crew. We do not know if the Navy Department has taken the hint to supply war ships with these hammocks, or whether it is waiting for another Huron calamity to develop the idea. The Doctor has suggested the use of the same material for the hoods of waterproof cloaks or wraps, for crinoline, and for ladies' long boas (which could be instantly put around a child's body under the shoulders), and for the inside lining of coats, etc.—the lining to be double and quickly inflated by an automatic valve. It is important to utilize articles of dress, beds, and hammocks for life-saving purposes, as travelers are not willing to burden themselves with special life preservers.

Who will take the hint of the SCIENTIFIC AMERICAN, and provide the public with a simple, cheap, and reliable life-saving apparatus? J. E. PARKER.

Philadelphia, October 9.

Bishop Ferrette on the Cedars of Lebanon.

To the Editor of the Scientific American:

In connection with the article which has appeared in the SCIENTIFIC AMERICAN (November 2, 1878), questioning the great antiquity of the big trees of California and other places, may I be permitted to give to the public, through your intermediate, a parallel fact which fell under my observation with regard to the cedars of Lebanon?

I visited the cedars for the first time in the summer of 1860, and was struck by the similarity of cedars to fir trees. A cedar is in fact nothing but a big fir tree, of which there are many species, all closely related to each other. Having been born in a fir tree country, and knowing that those trees are not generally among those which take many years to attain their full size, I conceived some doubts as to any of the cedars, even the most enormous, being as old as Solomon's time.

But the next year I was able to set that question at rest, to my satisfaction at least, for I must confess that I am not in any special sense a botanist. I revisited the cedars in 1861, and found one of the five or six principal giants, at whose stupendous proportions I had wondered the year before, lying on the ground, having been rooted out by the snows and storms of the winter. Monks were busy sawing it into pieces, and had already severed from the trunk one of the two nearly equal stems into which it branched at about ten, certainly not more than twenty feet from the ground. I counted the rings at that place, and to my surprise they were only two hundred or thereabouts.

I confess it was difficult for me to believe that that enormous branch was only two hundred years old; and if it was only that age, the whole tree could not have been much older, for fir trees, so far as I am aware, never grow new branches below older ones; and when that branch was first projected, at twenty feet or less from the ground, the tree could not have been much more than twenty years old. JULIUS FERRETTE.

P.S.—It might be useful to add that my conclusions in this respect are not influenced by my theology, according to which any tree might be as well ten thousand as two hundred years old.

Cambridge, Mass., 26th October, 1878.

Early Manufacture of Steel Pens.

To the Editor of the Scientific American:

I write to inquire if you can give me information concerning the manufacture of metal pens in this country. I may be vain in the supposition, but I am almost persuaded that my people—the Shakers—were the originators of metal pens. I write this to you with a silver pen, "one slit," that was made in the year 1819 at this village by the Shakers.

Two or three years previous to the use of silver for pens, our people used brass plate for their manufacture, but soon found silver preferable. Some of our people, now living, sold these pens in the year 1820 for 25 cents each, and disposed of all that could be made at that price.

The machinery for rolling the brass and silver plate was a home invention; also the shears for cutting the pens; these we still have in our possession. At the above date the inventor writes: "I now have my new shears, with which I have cut 292 pens in 14 minutes; this is doing it with dispatch!" The metal used was melted silver coins; and at one time the worker says, "I melted up $55.00 or $60.00 of silver money." I find the following in a late Boston paper:

"English steel pens are almost entirely made by women. In 1828–29 the first gross of 'three slit' steel pens was sold wholesale at £7 4s. the gross. In 1830 they had fallen to 8s. and in 1832 to 6s. the gross. A better article is now sold at 6d. per gross."

I leave you to judge the merits of this pen, from the appearance of my chirography; and can assure you it has seen nearly sixty years' service. The two I have in possession are equally good writers, and were presented to me by my venerable friend, D. A. Buckingham, who, 58 and more years ago, engaged in the sale of pens. By giving me what information you are able I will be under many obligations. I neglected to say that the handles to these pens were made of both wood and tin; the tin one I have is tubular and closes the pen telescopically. G. A. LOMAS.

Shakers, N. Y.

[We find no record of the manufacture of metal pens in this country as early as 1820. At that time Gillott had begun to make steel pens in England. As early as 1803 barrel pens of steel were made by a Mr. Wise in England. Evidently Mr. Lomas writes with a good pen.]

Advantages of Experimental Study.

A paper read by C. M. Boutelle, at a late meeting of the Minnesota Educational Association, contains the following summary of the advantages that result from experimental work in natural science:

1. The ability to follow directions sensibly; this is something of which we see the need every day in our schools, and it is readily acquired by a course of experimental work.

2. The ability to construct and use apparatus comes from a use of the experimental method of study and teaching. When a teacher or a student understands the use of tools many articles of great use can be made at a very small expense. Students or teachers will be gainers by being thrown upon their own resources. A complete and well arranged laboratory may be so used as to cramp the ingenuity and independence of an experimenter, and so be a positive disadvantage.

3. The actual seeing of a phenomenon, or the handling, tasting, and smelling of some chemical substance, carries with it a knowledge obtainable in no other way. The student who learns a printed statement is likely to forget it, for the imperfect knowledge has gone into his mind in but one way, and second hand at that, while the thing itself once known may, whenever encountered again, appeal for recognition to all or to nearly all of the senses. There are odors, for instance, common in the chemical laboratory, that once known are never forgotten, which are beyond the power of words to describe.

4. Apparatus in books always works well. In practice there are accidents the educational value of which the student of physical science cannot afford to miss. If things will burn, or break, or explode, there is no way of knowing it better or remembering it longer than by experience.

5. The reality of some slight change, some variation in the weight, color, or temperature, comes home only to the student who observes the change itself.

6. The cultivation of a scientific faith, of a belief in things understood but not seen, is not the least of the advantages of the study of experiments. Pupils can be led to recite glibly book statements which they do not believe in the way that facts should be believed. Students will look with genuine wonder at a few ounces of water supported in an inverted goblet over the mouth of which a slip of paper or of glass has been placed, but will state without hesitation that the atmosphere presses with a force of nearly fifteen pounds to the square inch and in every direction.

7. The habit of associating phenomena with their descriptions and explanations will be acquired after a time. Students at first find a genuine difficulty in this matter.

8. The habit of seeing what is going on in the world around us grows as we use the method of experiment. There are many things happening all about us from which the skillful teacher can draw illustrations for the use of his classes. Some great advances have been made in science because men saw what happened, how it happened, and all that happened. Things had swung, in nature and in art, ever since the world began, but an observing young man (20 years old, only), a man with eyes and the habit of using them, discovered the principle of the pendulum, before unknown.

9. To one who does experimental work, and loves it, there cannot but come a habit of looking for the reasons of things. "What?" is the question asked of nature by the experiment. "Why?" is the question the mind sets itself to answer. Science has always been the gainer by this habit; right or wrong, every theory that attempts to explain a group of related phenomena is of benefit. The theories, now known to be false, mere names long ago, marked steps in scientific progress as truly as do the accepted theories of to-day.

10. The culture that comes from a use of scientific work will have a tendency to enable men to see what there really is in the everyday and commonplace. It is too late for a falling apple to suggest anew the law of universal gravitation; it is too late for us to attempt to produce, from the fact that if a certain kind of vibration produces a certain sound, repeating the vibration repeats the sound (a fact, by the way, as old as speaking and hearing), a machine like the phonograph or the telephone; but it is not too late for the pupils in our schools to study science and to keep their eyes open.

A Gas Clock.

It is said that there is a clock in the Guildhall Museum, London, of which the motive power is hydrogen gas, generated by the action of diluted sulphuric acid on a ball of zinc. The clock itself resembles a large colored glass cylinder without any cover, and about half full of sulphuric acid. Floating on the top of this acid is a glass bell, and the gas generated forces forward this concave receiver until it nearly reaches the top of the cylinder, when, by the action of a delicate lever, two valves become simultaneously opened. One of these allows the gas to escape, thereby causing the receiver to descend, and the other permits a fresh ball of zinc to fall into the acid. The same operation is repeated as long as the materials for making the gas are supplied, and this is effected without winding or manipulation of any kind. The dial plate is fixed to the front of the cylinder, and communicates by wheels, etc., with a small glass perpendicular shaft, which rises with the receiver and sets the wheels in motion.

Special Senses in Insects.

The eminent French naturalist, Père Montrousier, details the following experiment that he has made. He immersed a long-snouted weevil so as to cover it, all but the tip of the antennæ, with a coating of wax. On presenting to it oil of turpentine it became violently excited and endeavored to escape. Another now had the tips only of its antennæ coated with the wax, and neither turpentine nor any other strong smelling substance at all affected it.

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THE ELECTRIC LIGHT.

The apparatus exhibited by Messrs. Wells & Co., of Shoreditch, for the production of electric light by the Jablochkoff process, is shown in the engraving, for which we are indebted to the London *Graphic*. It consists of a Gramme machine, a section of which is given to show the arrangement of magnets around a central axis. This rotates about 1,100 times per minute, and is driven by any ordinary engine. The Jablochkoff candle consists of two sticks of moulded carbon, embedded in a mass of composition to give them solidity, and are separated by a column of plaster of Paris, which acts as an insulator. The two carbons are connected at top by means of a thin stick of carbon one millimeter in diameter. The entire candle is held in a strong metal clip. Four of these are contained in a lamp, and are burnt in succession, an automatic arrangement shifting the current as each one is burnt out.

Messrs. Wells exhibited three of these lamps inside and one outside of their large show rooms, the illumination of which was perfect, showing colors distinctly, and, being diffused, did not cast heavy shadows. They afterwards burnt six candles on one stand, simultaneously producing a brilliant light and solid shadows. As to the light itself, there is but little difference, and that only to be noted by experts, between it and the light produced by the systems that have already been adopted in London. It is of a very powerful character, and it extends its illuminating influence for a considerable distance without much apparent diminution of strength.

electric candle consumes per hour 77 grains of crayon, composed simply of coke and plaster; the ton of best coke costs $9.00, and the pound of plaster 3 cents. Taking these figures as a basis, we find that the consumption of my candle, representing 100 jets of gas, costs 0·0055 cent per hour, which gives a figure almost impossible to formulate. Multiplying by 1,000, we may say that an electric light replacing 10,000 jets of gas costs 5½ cents, while these 10,000 jets represent an expense of 84 cents per hour. No one could prove these figures inaccurate, and yet I should never dare to represent them as realizable in practice. As to the cost of the electric light, I shall only say this—wherever it has been employed there has been a very notable economy. In the Louvre, for example, where this light has been in use for a year, the proprietors of the magasins have proved a saving of 30 per cent, and with more light than with gas. I conclude by saying that progress in the cheapness of the light is clearly indicated. The electric candle, which is manufactured at this moment at the rate of from 3,000 to 5,000 per day, and in consumption costs 10 cents per hour, must necessarily become cheaper when we manufacture 50,000 per day; but to announce the future eventual result as an accomplished fact is to mislead the public."

Recent Military Balloon Experiments.

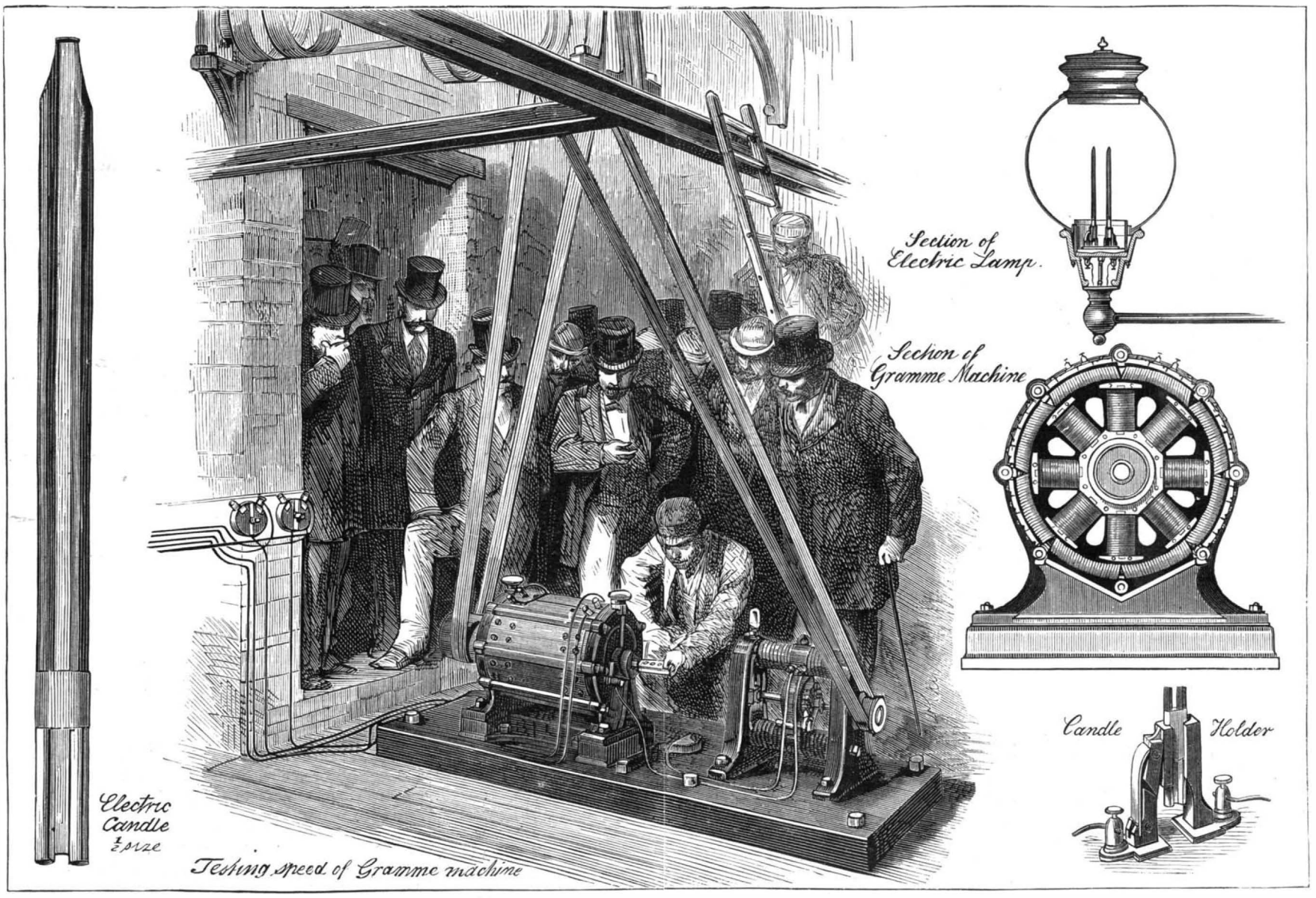
The military balloon experiments at Woolwich have been so far successful that lately an aeronaut was lifted some 700 feet, to a height, therefore, sufficient for reconnoitering purposes. There is nothing of novelty in this, as a matter of aerial navigation, although it is the first instance, we believe, of any one in this country being raised from the earth by the agency of pure hydrogen, but it is, nevertheless, something to have achieved in the circumstances under which Captain Templar has been working. Everybody knows that hydrogen is gifted with extraordinary lifting power, just as every chemist is aware that the gas may be produced in the way Captain Templar produced it, namely, by passing a jet of steam over iron turnings. But the problem under solution was not to send up a hydrogen balloon so much as to discover whether the thing could be done in a haphazard fashion, and with such simple means as an army in the field would be provided with. It is one thing to make hydrogen in the laboratory, and another to make a sufficient supply of it just whenever the commander of an army may order a balloon reconnoissance to be made.

Captain Templar has practically proved that this can be done. He requires a supply of steam, an improvised furnace of some sort, and a tube filled with iron turnings; given these, he can provide hydrogen sufficient to lift a scout high into the air. The tube at present employed by Captain Templar is six or eight inches in diameter, and some half dozen feet long; it is filled loosely with iron turnings and placed in a furnace where it becomes red hot. Steam is now passed through the tube, and hydrogen issues forth, the oxygen from the decomposed steam going to form ferrous oxide. So completely do the iron turnings do their work under these circumstances, that not only is the surface of the metal acted upon, but it is oxidized well nigh throughout.

Naturally enough, the hydrogen comes away with a good deal of vapor, and, if pure gas is desired, some desiccating arrangement will have to be employed; but so far Captain Templar has used none. His balloon, which is of lawn, dressed with boiled oil and glue, will contain about 10,000 cubic feet, but last week not more than 9,000 feet of hydrogen was introduced. The gas was generated from the tube at the rate of something like 1,000 cubic feet per hour, and there can be little doubt that, during the long period of filling, a large quantity of the vapor that was mixed with the hydrogen condensed and ran out of the balloon in the form of water. Pure hydrogen should have a lifting power of 70 lbs. per 1,000 feet, or perhaps a little more, but it is hardly likely that gas produced in a rough and ready fashion in the field will possess this degree of buoyancy. Still Captain Templar was successful in lifting balloon, aeronaut, ballast, and 700 feet of rope—for the ascent was a captive one—by means of 9,000 cubic feet of hydrogen, prepared in the way we have mentioned.

Another point is worthy of note in connection with the experiment. The fabric of the balloon kept the hydrogen imprisoned for a much longer period than had been anticipated. A dozen hours scarcely impaired the buoyancy of the balloon, and by adding yet another waterproof coating it is anticipated that the balloon will remain inflated for four-and-twenty hours.

The next step will be to discover how far it is possible to compress hydrogen so manufactured into cylinders for conveyance in transport wagons, so that a supply of hydrogen may be at hand whenever an ascent is determined upon in the field. Captain Templar is sanguine of compressing the gas to a fourth of its volume, and thus decreasing its bulk considerably, when the balloon train is on the march. How far this is practicable experiment only can prove.—*Nature.*



THE ELECTRIC LIGHT.—SKETCH OF THE APPARATUS.

M. Jablochkoff, the inventor of this form of the electric light, writing in reply to the question as to what distance from the source of electricity a luminous center may be produced, says that the distance may be as great as is wished, only it is necessary to employ a conductor of very great diameter in order not to increase the total resistance of the circuit. In reference to Mr. Edison's claim to have solved the question of the divisibility of the light, M. Jablochkoff writes that he long ago realized its divisibility, as is proved by communications from him to the Academy of Science and the French Physical Society, in December, 1877, and February, 1878. It has, moreover, he states, been shown in public at the Sorbonne, and has been in use at the Exhibition since the 1st of May. M. Jablochkoff says:

"In view of this fact, it may not be inadvisable to say a few words on the calculations which have been made as to the cost of the light. These calculations are of two orders. The opponents of the electric light represent it as costing very dear; its partisans, and, above all, its propagators, on the contrary, give figures which we may not, perhaps, call inexact, but which, nevertheless, are only theoretical figures, and, consequently, little capable of being justified by practice. To better understand my idea, I shall suppose the following calculations for my candle. The

Spontaneous Combustion.

According to the Boston *Journal of Commerce*, at the semi-annual meeting of the New England Cotton Manufacturers' Association, in Boston, Professor Ordway made a report on certain chemical properties of commercial oil, and incidentally discussed spontaneous combustion. Experiments had been attempted to ascertain the facts concerning spontaneous combustion, which is oxidation of oil when spread out over a large surface. It was found that in time all oil, whether animal or vegetable, took fire. One of the most important things to be ascertained in the experiments was the correctness of the opinion put forward as a result

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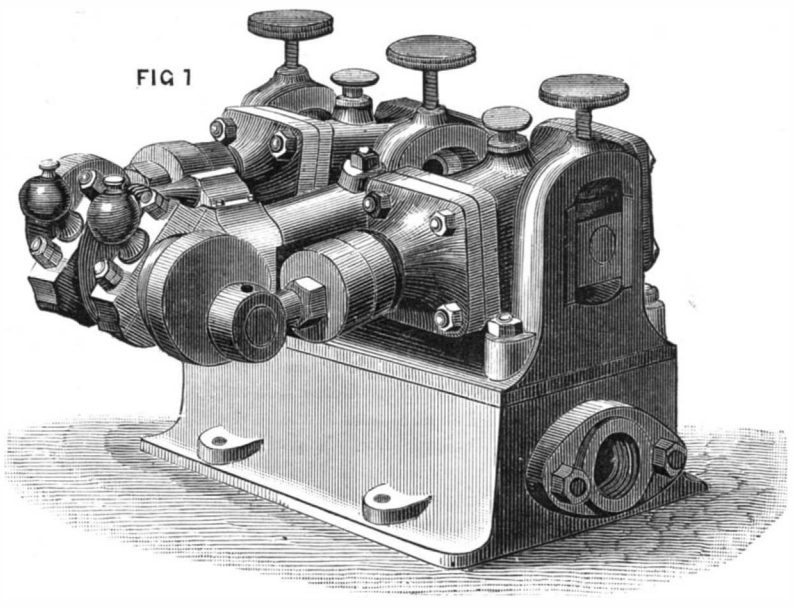
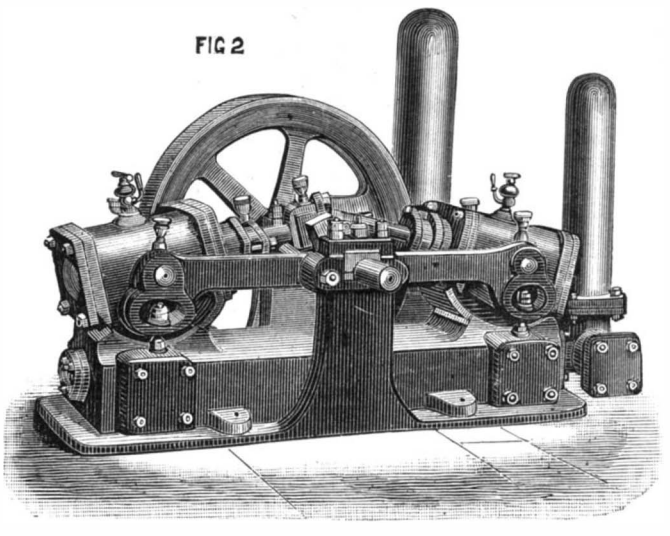
of recent experiments in Europe, that animal or vegetable oil when mixed with a mineral oil would undergo spontaneous combustion. It was found that cottonseed oil would take fire even when mixed with 25 per cent of petroleum oil. But it was ascertained beyond a doubt that even 10 per cent of mineral oil mixed with an animal or vegetable oil went far to prevent combustion. Professor Ordway described some experiments in other directions, but explained that they would have to be continued before definite deductions could be made. In connection with the tests of the flashing point, experiments had been made with ten specimens of kerosene oil bought at different stores in Boston. The flashing point should be at 130° Fahrenheit. Downer's kerosene was found to be good at 134, but the other specimens flashed respectively at 84, 80, 81, 117, 79, 73, 125, 79, 80, 84 degrees. The professor was of the opinion that it was time for somebody to look after the kerosene oil sold and used in Boston, when out of ten specimens bought at random only one was fit to use with safety. He remarked the fact that oils bought under the same name, from the same manufacturer and at the same price, differed very much in quality. Another remarkable circumstance was that some oils which flashed at a low point were high priced, and *vice versa*. Closing, the professor recommended that manufacturers of oil should be aroused to a greater sense of their responsibility.

HYDRAULIC MOTORS AT THE PARIS EXHIBITION.

M. A. Schmid had at the Paris Exhibition several applications of his patent hydraulic motor or pump, which is figured in *Engineering* as below. Its specialty lies in the manner in which the distribution of the water before and behind the piston is effected by means of the oscillating cylinder. The sectional areas of the inlet and outlet pipes are very large in proportion to the area of the piston, by which means the passage of the water is in no way restricted, and the constant pressure and absence of shock produce a more even action of the engine. It can be applied wherever there is sufficient height of water, or can be driven by steam; can be used as a motor or as a pump, or, as shown in Fig. 2, can be combined into both. When used as a motor the motion is forwards, the admission from either side, and the exit below; as a pump the motion is reversed, the admission of water or suction is from below, and the exit or pressure is on either side. Air vessels are used with the pumps. When this motor is used in the combined form, as a direct acting steam pump, both piston rods are coupled to the same crank axle. In the one exhibited the diameter of the cylinder is 6 inches, and the length of stroke 8 inches, and with a speed of 90 revolutions it delivers 110 gallons per minute. Another application of the same principle of construction is shown as a hydromotor, which consists of two of the hydraulic motors coupled together and driven by the pressure of the fluid passing through them. The oscillating cylinders are kept watertight up to the faces of the valve ports by adjustable screws, whose tension naturally depends on the pressure with which the fluid is actuated. The advantages claimed for the motor are that its speed depends entirely on the quantity of the water passing through it, and that the variations through leakage, etc., are less than in any other, the results given from numerous experiments conducted by Messrs. Sulzer Brothers, of Winterthur, giving an average discrepancy of not more than 1·72 per cent. All the above machines were shown in motion, as well as some well constructed air pumps for compressed air and vacuum, and a small engine on the same principle for working sewing machines.





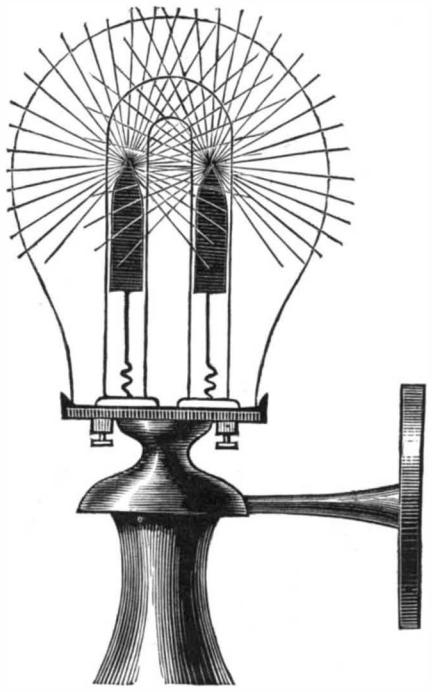
NEW HYDRAULIC MOTOR.

Another Mountain Railroad.

A railway up Vesuvius is to be constructed within the next few months, if the threatened eruption does not interfere with the present plans. A London contemporary states that there will be a double line of rails laid on an iron framework, supported by iron pillars, on which will run eight small carriages, drawn by a wire rope instead of the usual locomotive, and so arranged that four will be making the ascent as the four others descend. These carriages will hold four persons apiece, and will be kept some two hundred yards apart, while strong automatic brakes are to be fitted, so as to stop the carriages immediately if the rope should break. The line will be somewhat over half a mile long, and the gradients very steep—1 in 2.

BURNER FOR ELECTRIC LIGHT.

The annexed engraving shows a sketch of a new burner for the electric light. It consists of a glass tube, one half inch inside and about ten inches long, which is bent to the



FAHRIG'S BURNER FOR ELECTRIC LIGHT.

shape shown, both arms as close as possible together. A small hole is drilled in the top of the bent tube to insert two pieces of wire, No. 30 platinum. Length of platinum wire one inch and three quarters inside each arm of the tube. Two carbon pencils, well fitted to the tube and one inch and a half long, connected on the flat end to a copper wire of No. 12 thickness, are now inserted into the tubes, the points toward the platinum wires, leaving one quarter inch space between the carbon points and the ends of wires. The tube is now warmed, and the air expelled, and quickly sealed and cemented with any fire resisting cement. The two platinum wires are one pole, the two carbon wires the other pole, to be attached to the battery or magneto-machine power. The light so obtained is very brilliant, steady, and clear, having many advantages over the two-point carbon burner, and dispenses with the costly regulator. How far the success of the new burner can be estimated is not known, and must be proved by longer experiments; but as at present it is worthy of adoption and improving in this direction. A bell-shaped globe is better than a round one.—*F. E. Fahrig, in English Mechanic.*

Preservation of Iron.

In 1877 Professor Barff, of London, first reported on some experiments made by him in regard to bronzing iron by the action of steam. The metal is by the process covered with a layer of magnetic oxide, adhering firmly and affording protection against the influences of the atmosphere.

According to M. Krafft, C.E., in *Annales des Ponts*, etc., M. Bourdon, captain of artillery, stationed at the government factories at Tulle, France, has now tried a similar process to bronze all kinds of arms. He inclosed the articles to be bronzed in a cylinder closed at both ends by riveted plates, into one of which the steam supply pipe ended, while the other was supplied with three openings. Into one of the latter a thermometer was fitted; the second one is supplied with a stopcock through which to allow the water condensed to run off. This must be done frequently, as the steam must be as dry as possible. The third opening is taken up by an escape valve for the steam.

The most favorable conditions for success are the following: The pressure must amount to two or two and a half atmospheres, the temperature must be from 330° to 340° C., and five hours of time must be allowed for the completion of the operation. Thus a covering of a greenish black color is obtained which adheres firmly and is perfectly stable.

It must be remarked that the cylinder is placed in a sort of oven, maintaining its shell at 500° C. The thermometer plunged in the steam of the interior with its registered part protruding so as to allow observations, however, only showed 340°. If the current of steam is stopped, the thermometer will almost instantly rise to 500°.

The bronzing was thus a perfect success; care must, however, be taken that no parts of the articles are soldered together by tin solder, as the latter melts at 228° C. Even if the connection remains intact, there will always be a few minute globules of solder detached and stains caused. Copper must be used instead.

In further following up his experiments, Captain Bourdon conceived the idea of replacing the steam by hot air. He proceeded as follows: A coil of pipe communicating at one end with the open air ascends gradually through a reservoir heated to 120° C., from whence it enters the cylinder in which the articles to be operated upon are inclosed. This cylinder is identical with that used for steam. The escape valve leads into a tank with water, permitting a better regulation of the air current. This must pass very slowly. The interior pressure is but a little above one atmosphere, as the apparatus communicates with the open air.

The temperature of the air in the cylinder is 280° C.; the time consumed, five hours. A layer of 0·05mm. thickness was obtained, resisting the action of 00 emery paper and left unaffected by diluted sulphuric acid. The layer possessed a fine greenish black color.

To insure perfect success the articles must be suspended perfectly free. After removing them from the apparatus they are rubbed with a greasy cloth; stains, if any should be present, are removed with emery paper or iron dust.

It has been found that with an elevation of temperature under pressure of one atmosphere a very thick layer is obtained, which, however, scales off easily. The adherence is, therefore, a question of temperature and not of pressure, as was formerly supposed.

Those pieces bronzed by hot air were for one month exposed to the weather without being attacked in the least. On removal of the exterior black rind a gray layer is discovered below the same, which to some extent becomes rusty on exposure. The rust, however, does not adhere as on metallic iron, but is easily removed by scraping with a piece of wood. This fact also applies to articles bronzed by steam.

It will be seen that bronzing by air is applicable to industrial purposes; for instance, to the preservation of the interior surface of marine boilers, steam pipes, etc.

Last June Captain Bourdon tried the process on 400 rifle barrels at once. Similar trials have since been made, showing the practicability of using it on a large scale. The principal point is to obtain a current of air sufficiently abundant to secure a proper thickness of the layer, but of a circulation slow enough to allow the air to act on the iron. The French Government has already adopted the process at some of its arsenal manufactories; for instance, at St. Etienne and Chatelerault.

GUTTA PERCHA cuttings are very useful for the laboratory. By dissolving them in benzole and adding a little carmine or any other pigment, a solution is obtained which when brushed on the cork and neck of a bottle forms a tight fitting cap, impenetrable to air, dampness, alcohol and acids, and can be taken off without difficulty.—*Deutsche Photographen Zeitung.*

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New and Stale Bread.

The nature of the difference between new and stale bread is far from being known. It is only lately that the celebrated French chemist, Boussingault, instituted an inquiry into it, from which it results that the difference is not the consequence of desiccation, but solely of the cooling of the bread. If we take fresh bread into the cellar or into any place where it cannot dry, the inner part of the loaf, it is true, is found to be crummy, but the crust has become soft and is no longer brittle. If stale bread is taken back into the oven again, it assumes all the qualities of fresh baked bread, although in the hot oven it must undoubtedly have lost part of its moisture. M. Boussingault has made a fresh loaf of bread the subject of minute investigation, and the results are anything but uninteresting.

He took a round loaf, one foot in diameter and six inches thick, and plunged a thermometer into it three inches deep immediately on being taken out of the oven. When the thermometer was taken out it was found to indicate 78° Réaumur (207·50 Fah.). This might well appear surprising, seeing that the oven was heated to 240° R. But we must consider that in the inside of the loaf, on account of the water with which the dough has been mixed, the temperature cannot rise above boiling heat, that is, 80° R. (212° Fah.), as long as the bread has not lost all its water and become perfectly dry; but it takes a long time to come to that on account of the protective thick crust. The loaf was then taken into a room heated to 150° R., the temperature of the air. At this time it weighed 7½ lbs. In twelve hours the temperature of the loaf sank to 19°, in 24 hours to 15°, and in 36 hours to 14°. In the first 48 hours it had only lost 2 ounces in weight, which, in a loaf of such a size and weight, must be considered an insignificant loss. When after 6 days the loaf was again put into the oven, and the thermometer indicated that its temperature had again risen to 55° R., it was cut and found to be as fresh and to possess the same qualities as if had been taken out of the oven for the first time; but it had lost now not merely 2 ounces, but 12 ounces in weight. M. Boussingault now made separate experiments with slices of the loaf, and also with the crumb, all of which showed precisely the same results, so that it may be considered fully established that stale is distinguished from new bread less by containing a smaller quantity of water than by a peculiarly altered molecular condition, which begins to manifest itself in the process of cooling, which continues to develop itself more and more, and lasts as long as the temperature remains essentially unchanged, but is annulled the moment the temperature has reached a certain height. The molecular condition is the form and the union of the smallest parts dependent upon it; it decidedly indicates a mechanical relation which undergoes changes in consequence of chemical processes. It is this mechanical relation also which makes the difference dietetically between new and stale bread. New bread, in its smallest parts, is so soft, clammy, flexible, and glutinous (in consequence of the starch, during the process of fermenting and baking, being changed into mucilaginous dextrine), that by mastication it is with greater difficulty separated and reduced to small pieces, and in its smallest parts is less under the influence of the saliva and digestive juices. It consequently forms itself into hard balls by careless and hasty mastication and deglutition, becomes coated over by saliva and slime, and in this state enters the stomach. The gastric juice being unable to penetrate such hard masses, and being scarcely able even to act upon the surface of them, they frequently remain in the stomach unchanged, and, like foreign bodies, irritate and incommode it, inducing every species of suffering—oppression of the stomach, pain in the chest, disturbed circulation of the blood, congestions and pains in the head, irritation of the brain and inflammation, apoplectic attacks, cramp, and delirium.—*The Miller*.

Leather from Sheep Stomachs.

Among the recent patents is one issued to Edward Tivet, of Philadelphia, for a process of treating sheep stomachs, by which means a light and serviceable leather is produced particularly adapted for purses, bags, and other similar articles, as the leather produced by it is in the form of sacks or pouches.

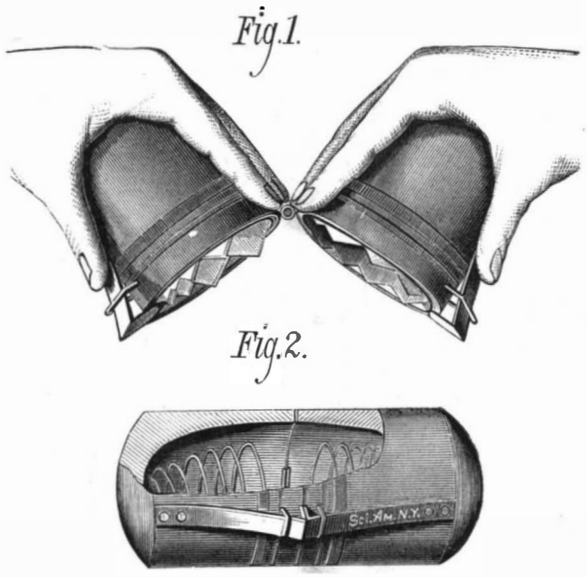
The following is the process: Take the stomach proper of the sheep, in the state in which it comes from the animal, the gut and ligaments being previously or subsequently severed, and empty it, and, while it is yet fresh, remove by a dull scraper the softest or least adherent layers of the external covering or serous surface, thus leaving the firmest part of the peritoneal or serous surface adhering to the muscular or middle membranes. The stomach is now turned inside out and brushed, so as to remove the mucous surface, thus leaving only the muscular tunic or middle membranes, covered on the outside by the portion of the serous membrane that remains, the result whereof is a thin white integument, presenting on the inside a multitude of *papillæ*, intimately adhering to it, which integument is to be treated so as to be preserved and its pliability retained. This may be accomplished by any known process of tawing or tanning, some glycerine being used for keeping the pelt in a suitable state of moisture. Among these processes the following may be mentioned. For tawing about ten pounds of the prepared integuments, form a paste of one half pound of alum dissolved in one half gallon of water, one and a half pound of best wheat flour, the yelks of one dozen eggs, and five ounces of pure concentrated glycerine, more or less, all well mixed together.

The integuments are placed in the paste, and permitted to remain therein for about one day, after which they are wrung out and hung up to partially dry, are then stretched to shape, and a small quantity of linseed oil rubbed over the muscular surface of the integuments, which are then permitted to dry to the full extent.

If desired, dye stuff may be advantageously applied to the integuments prior to the treatment with the paste.

A NOVEL EGG OPENER.

For almost every operation in the shop or household there are devices which not only save labor, but accomplish results more satisfactorily. The simple device shown in the accompanying engraving is one of those useful things that



EGG OPENER.

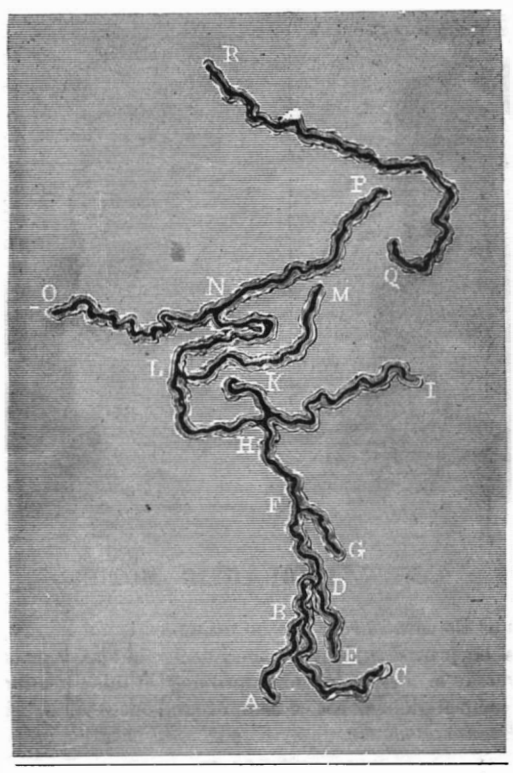
eventually finds its way into almost every house. It consists of two cups hinged together at one side, and each having at the opposite side a flat spring, the end of which is bent inward. Each cup contains a conical spiral spring for holding the egg in a central position when the device is shut.

The egg is inclosed in the cups, when the two flat springs are pressed inward so as to break the shell, after which, and while the springs are still pressed, the cups are opened, separating the shell and discharging the contents thereof. Upon releasing the flat springs the shell is thrown out by the spiral springs.

This device was recently patented by Mr. G. W. H. Kry, of Brooklyn (E. D.), N. Y.

ARTIFICIAL BALL LIGHTING.

The mica plate condensers which enter into the construction of Planté's rheostatic machine (*Comptes Rendus*, vol. lxxxv.) are sometimes pierced, when the plates of mica are too thin, under the action of a current from 800 secondary couples, the same as the glass of a Leyden jar too strongly



PATH OF ELECTRIC SPARK OVER A SHEET OF MICA.

charged by an electric machine. This accident has given M. Planté the occasion to observe a very curious fact, which consists in the slow and progressive movement of the electric spark. One of these condensers being placed upon an isolated metallic plate, in connection with one of the poles of the secondary battery, and the upper armature being touched with the other pole, a spark bursts forth upon some point of the surface of the too thin condenser, forming a fissure in advance of it. This spark then begins to move in the form of a very brilliantly luminous little globule, accompanied by a peculiar rustling sound, and slowly traces, on the tin foil of the condenser, a deep sinuous and irregular furrow. The annexed engraving gives a faithful representation of a part of the surface of a condenser on which the phenomenon has taken place. The spark appears at first at A, soon ramifies to B, then to C, then disappears to immediately reappear at the point, B, with such rapidity, and in such an inappreciable interval of time, that it seems to have made a leap. It directs itself afterward toward D, where it forms a new ramification, which ends at E, reappears at D, continues its course toward F, and so on. Sometimes (as in the present case) the spark shows itself anew further off at a point, Q, detached from the principal furrow, to end afterward at R, and the phenomenon only ceases when the sheet of mica no longer presents a portion thin enough to be traversed. In other cases, the spark remains for some time stationary around the same point; at other times, again, one of the branches elongates out of all proportion, and describes over the whole surface figures analogous to those on a geographical map. It should be understood that a tube of water is interposed in the circuit of the secondary battery, for the purpose of avoiding too intense calorific effects, and the deflagration of the whole condenser. During the progress of the phenomena, it cannot be foreseen through what points the spark will pass, and nothing is more strange than the movement of this dazzling little globule, which is seen slowly making its way and choosing the points toward which it is to direct itself according to the greater or less resistance of the different points of the isolating plate. The condenser is found to be cut through in the pathway of the spark, and the melted tin forms a double row of beads along the edges of the consumed mica. It is a sort of Voltaic arch produced successively at the expense of the material of the condenser, as in the electric candles of M. Jablochkoff; but the mica here contributes more to the brilliancy of the globule than does the incandescence of the metal, producing (like quartz and the silicates) electrosilicic light. This experiment may throw a new light on the phenomena of "ball lightning." It confirms the opinion already expressed on this subject by M. Du Moncel, in 1857, as well as certain views since proposed by M. Planté, and based on other experiments. It results from what has been said that, at the point where lightning of this kind manifests itself, there must very likely be formed the elements of a condenser, in which a powerfully electrified column of moist air plays the part of upper armature, the soil that of the lower armature, and the layer of interposed air that of the isolating plate. Here the spark is doubtless a globule of matter in fusion, of a different nature from that which constitutes the balls of lightning. But M. Planté has already shown, too, that there may be obtained, with dynamic electricity at a high tension, globular electric flames formed solely of the elements of the air and gases from the vapor of water, rarefied and incandescent; and that these globules naturally followed the movements impressed on the electrode under the conductive surface.

It only remains to show now that, were luminous electric globules formed of another matter, they might move spontaneously and slowly, even when the electrode remains immovable.

The experiment just described puts this fact in evidence, and appears to be of a nature to explain particularly the slow and capricious movement of ball lightning.

New Sources of Rubber.

The director of Kew Gardens (Eng.) has given much attention to the matter of extending the sources whence this valuable product is obtained. In his annual report he states that though a large proportion of the young plants of the Para rubber (*Hevea Braziliensis*) brought to Kew failed to thrive, seeds and plants of the Ceara rubber have been obtained, and a considerable stock successfully raised. Para rubber plants have been transmitted to Calcutta for distribution to Assam and Burmah, where, it seems, they are now doing well. Favorable reports have also been received from Singapore, where it is said that, judging from the progress the plants have made, the climate is evidently suited for their growth. The same may be said of Ceylon, whence the superintendent of the government gardens reports that cuttings of *Hevea* strike readily, as well as those of *Castilloa* and the Ceara plant.

In Jamaica, also, the plants of *Hevea* are doing well. The propagation of the Central American rubber plant (*Castilloa elastica*) is still being proceeded with at Kew, and during the past year plants of this species were sent to Liberia, Mauritius, Singapore, and Ceylon. The Ceara rubber, owing to its totally different habit from that of the other two species, will, it is thought, prove to be best fitted for cultivation in Bengal and the drier parts of India.

Regarding new sources of India rubber, reference is made to a creeping Burmese plant, the *Chavannesia esculenta*, which was first noticed so long back as 1860, and again made the subject of a pamphlet published in India in 1874. The plant is there stated to be one "for whose extermination in the teak tracts an annual budget provision is made." From Fiji samples of rubber were received at Kew, which were reported as "a strong, elastic, pure rubber, of the same character as the higher grades of African rubber." This rubber would seem to be the produce of a plant closely allied to *Tabernæmontana pacifica* or from *Alstonia plumosa*, both of which appear to yield caoutchouc in Fiji, and both of which belong to the same natural order Apocynaceæ. Regarding the rubber producing plants of the east and west coasts of Africa, which are referred to as species of *Landolphia*, also belonging to the same natural family as the pre-

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ceding, the director reports that, "being climbing plants which ascend lofty trees, they could not be grown like other rubber producing trees in independent plantations. But they would doubtless flourish in the jungles of any tropical country."

Natural History Notes.

The Spontaneous Movements of Plants.—In a memoir recently read by the eminent scientist, M. Paul Bert, before the Academy of Sciences, the author gave his views in regard to the causes of heliotropism and the periodical movements of leaves and flowers. It is known that there exists at the base of these organs a cushion-like swelling. From the different experiments made by him, especially with the sensitive plant, M. Bert believes that he is in a position to assert that the periodical movement of these plant organs is due to a solution of glucose, which, under the influence of light, fills the cavity of these dilatations. The increase of weight resulting therefrom destroys the equilibrium of the organ, and causes it to present as much surface as possible to the light, and consequently to evaporation.

Ants, and the Larva of a Butterfly.—The behavior of ants towards aphides, from which they obtain supplies of a sweet secretion agreeable to their taste, has long been known. It is now announced that ants have a way of cherishing the larva of the azure blue butterfly (*Lycæna pseudargiolus*) for the tasteful liquid that it exudes. In a recent issue of the *Canadian Entomologist,* the well known lepidopterist, Mr. W. H. Edwards, records some observations of this kind, from which we gain the following facts: The ants, when discovered on a stem, will invariably be on or near the larva. They run over the body, caressing it with their antennæ, plainly with the object of inducing the larva to emit a drop of the fluid on the eleventh segment. Most of this caressing is done about the anterior segments, and while the ants are so employed, the tubes of the twelfth segment are almost certainly expanded to their full extent, and so remain, with no retracting or throbbing, until the ants come tumbling along in great excitement, and put either food or antennæ directly on or close by the tubes, when these are instantly withdrawn. The ants pay no heed to the tubes, do not put their mouths to them or to the openings from which they spring, nor do they manipulate that segment. They seek for nothing and expect nothing from it. But they do at once turn to the eleventh, caress the back of the segment, put their mouths to the opening, and exhibit an eager desire and expectancy. By holding the glass steady on the eleventh, a movement of the back of this segment will soon be apparent, and suddenly there protrudes a dull green, fleshy, mammilloid organ, from the top of which comes a tiny drop of clear green fluid. This the ants drink greedily, two or three of them perhaps standing about it, and they lick off the last trace of it, stroking the segment meantime. As the drop disappears this organ sinks in at the apex and disappears, and is so withdrawn. The ants then run about seeking other larvæ on the same stem, but presently they all return, and the caressings go on as before. The intervals between the appearance of the globule varies with the condition of the larva. If exhausted by the long continued soliciting, some minutes would elapse, and the tubes meanwhile remain concealed; but a fresh larva required little or no urging, and one globule followed another rapidly, sometimes even without a retracting of the organ. Mr. Edwards states that he has counted six emissions in 76 seconds. The larva did not always await the approach to the eleventh segment, but gave out the drop unsought and as soon as it was aware of the ant's presence. Now and then the drop was preceded by a bubble several times larger than itself.

The Humming of Insects.—In a memoir on this subject recently presented to the French Academy by M. M. J. Pérez, the author states that among hymenoptera and diptera, humming is due to two distinct causes: one, the vibrations of which the articulation of the wings is the seat, and which constitutes the true hum; the other, the friction of the wings against the air, an effect which more or less modifies the former. Among the powerful winged lepidoptera, such as the sphinxes, the sweet and mellow hum of these insects is due only to the rustling of the wings by the air. This sound, always grave, is the only one produced; it is not accompanied by basilary beatings, on account of a peculiar organization, and especially on account of the presence of scales. Among the Libellulæ, the base of whose wings is provided with soft and fleshy parts, there does not exist true humming, but a simple noise due to the rustling of the organs of flight.

Mexican Grasses.—The botanist Fournier finds in Mexico 638 varieties of grasses, of which 376 occur in no other country. Of the remainder, 82 are common to the United States, 30 to Europe, and the rest to the West Indies, South and Central America.

Wasps under Chloroform.—A correspondent of *Nature* makes the following curious statement: A few days ago a friend informed me that she had often placed a bee under chloroform, and that the victims, when they found they must die, invariably brought their stings to their mouths and sucked the little drop of poison into their mouths. She offered to show me the experiment, and endeavored to catch a bee, but, failing to do so, caught a wasp, an insect upon which she had not previously experimented in this way, and we both eagerly watched to see if the wasp would behave as the bees had done under the influence of the narcotic. The wasp, being put under an inverted tumbler along with a piece of paper saturated with chloroform, in a very few minutes fell on its back, and almost immediately afterwards curled up the tail, with the sting protruded, and a drop of clear fluid on the end of it. The sting was brought to the mouth, and the drop of fluid disappeared. The wasp then became motionless. After a few seconds the tumbler was removed and the air allowed to play freely on the insect, but no sign of life appeared, except once a slight twitch of the wing. To test whether the wasp was really dead it was placed in a butterfly cage and left out of doors all night. Next morning the insect had disappeared. Is this peculiarity of wasps and bees, when subjected to the action of anæsthetics, well known? Is the poison a narcotic itself, and taken by the insect to dull its pains when death seems inevitable? The revival of the wasp appears to show that neither the chloroform nor the poison of its own sting is deadly to the insect.

The Chewstick of Jamaica.—The "chewstick," though not indigenous to Jamaica, is perhaps better known there than in other islands, where varieties of it are known. It is named by botanists *Gouania Domingensis,* and is a very beautiful thick bushy vine, with a profusion of foliage, climbing upon the trees growing in its neighborhood, and with a stem varying in thickness from that of a pencil to that of a cane. The stem is very fibrous, and when these fibers are detached at the end of a section of the stem by chewing, it becomes a rude but most perfect tooth brush, giving out in the mouth when rubbed over the teeth a saponaceous froth of a pleasant aromatic bitter taste, which remains in the mouth for some time, and which not only serves the purpose of a tonic when used in this way, but also whitens the teeth and hardens the gums; on this account it is very popular in Jamaica as a dentifrice among all classes, and has attracted a good deal of favor in foreign countries. It possesses also another peculiar property. If a quantity of the bruised vine be steeped in water, beer, or any kind of watery infusion, there is communicated to it a warm, bitter aromatic taste, and if the fluid so treated be poured out from one glass to another, it will be found to have acquired all the appearances of beer (minus its alcoholic flavor) in a high state of fermentation. On the latter account the chewstick plant ought to be very useful to brewers, since stale or immature beer would be improved by its use, giving to such fluids a warm, aromatic bitter taste, more agreeable than that given by hops, though certainly it does not possess the narcotic principle which makes hops so indispensable to the brewer and others.

A Case of Natural Selection.—Mr. S. F. Clarke describes a very interesting case of "survival of the fittest," in the *American Naturalist.* Having procured some of the gelatinous egg masses of one of our native salamanders, he placed them in large glass jars, where they rapidly developed. After their gills and balancers had developed, the animals emerged from the eggs and entered on their active aquatic life. The author not being able to discover the proper kind of food, began to watch the animals closely, and found that they were eating off each other's gills. Closer examination showed that, among the many, were a few individuals which, although from the same parent and subjected to the same conditions while in the egg, were yet endowed with greater vigor than most of their fellows. These few stronger ones ate off the gills of many of the weaker, and at the same time were enabled to protect their own gills from mutilation. These favorable conditions, the large supply of food and the better aeration of the blood, soon began to show their influence upon the growth of the favored individuals. Within a week or ten days from the time of emergence from the egg, these favored few were fifty per cent larger than their weaker fellows born on the same day. Their mouths had by this time so increased in size that, no longer satisfied with nibbling off the gills of their brethren, they now began to swallow them bodily. Soon they were ten or twelve times as great in length and bulk as their victims.

Mimetic Coloring in Tadpoles.—Miss S. P. Monks communicates to the *American Naturalist* an interesting instance of imitative coloration in some tadpoles caught in a weedy pool in Cold Spring, N. Y. The largest tadpoles were an inch and three quarters long, bodies half an inch long, and widest part of tail half an inch; the hind legs visible, but very small. They were greenish above with black markings, and had minute golden spots about the eyes and along the sides; beneath silvery white. Their tails were orange red for more than two thirds their length, the color deepening toward the end and along the margin. The largest tadpoles were more brightly and distinctly colored. In the same pool there grew a plant (*Ludwigia palustris*), the lower and submerged leaves of which were exactly the same color as that of the tails of the tadpoles. The brightest leaves were mostly full of holes. The tails of the tadpoles also resembled the leaves in shape and width. The color resemblance was so striking that a friend, who was not on the lookout for analogies, pointed out a leaf as a tadpole in the vessel in which both were placed. Some of the animals which the author had kept in a soup plate for several days became very much paler, and their spots grew almost invisible. These tadpoles were a good example of how early batrachia begin to adapt themselves to their color surroundings.

Double Flowers.—Professor Morren, in support of his well known theory of the incompatibility of truly variegated leaves and double flowers, points out that in the *Camellia* and *Kerria japonica* normal flowers are only known to occur on variegated stocks. In a *Hibiscus,* which unites these peculiarities, the flower buds fall without opening: in a variegated and double wall flower many of the branches revert and are quite green.

The Hearing of Insects.—Mr. Alfred Simson, writing to *Nature,* states that there is a wasp in South America which seems to present undoubted evidence of a faculty to hear, or it may be to feel, and distinguish certain vibrations of sound. This wasp is a common one on the Guayaquil river. It is a large, slender, black species, much feared on account of the virulence of its sting, which not unfrequently produces fever. The writer states that he himself, although little susceptible to the bites of mosquitoes or flies, the stings of scorpions, etc., when once stung on the finger by a "cubo" (as this insect is called in Ecuador), had his whole hand and forearm swollen from the effects of it for a couple of days. A common spot chosen by the cubo for its nest is high up on a palm stem at the river side, and the natives are well aware of the danger of uttering any loud cry when in its proximity. The writer had frequently experimented by giving a shrill whistle—something particularly abhorrent to the wasp—from a safe distance, with the invariable result of all these insects flying in confusion from the nest in manifest anger. It is said that there is a wasp in New Granada in whose proximity it is unsafe to speak, but possibly this may be an exaggerated account of the cubo. Still it would certainly be a dangerous experiment to speak loud when very close to a cubo's nest, even on the Guayas, and a shrill voice would be sure to irritate the creature.

A New Cave Discovery in Kentucky.

Another wonderful cave has recently been discovered near Glasgow Junction, Ky. It has already been explored for a distance of twenty-three miles in one direction, called the long route, and sixteen miles in another direction, called the short route. The avenues are very wide; a span of horses can easily be driven through for a distance of eleven miles. Three rivers, wide and very deep, are encountered on the long route. One of them is navigable for fourteen miles, until the passages become too narrow to admit a boat. This forms the third or river route, which has to be explored in a boat.

The cave is wonderful beyond description, and far surpasses in grandeur the Mammoth or any cave ever before discovered. Several mummified remains have been discovered in one of the large rooms. They were reposing in stone coffins, rudely constructed, and from appearances may have been in this cave for centuries. They present every appearance of the Egyptian mummies.

Great excitement prevails over this very important discovery. Mr. Edwin Mortimore, of Chestnut street, Louisville, Ky., purchased three of the mummies, and has them now in his possession. Major George M. Proctor, of Glasgow Junction, Ky., purchased the remainder of the mummies from the owner of the cave, Thomas Kelley. The latter is, or rather was a few days ago, a very poor man, struggling to make a payment on a farm of twenty-four acres, upon which, by mere accident, the entrance to this wonderful cave was discovered. He obtained about $400 for the mummies, and is now offered $10,000 cash for the cave.

The entrance to the cave is within the town limits, and is only about two minutes' walk from the depot, which makes it very valuable indeed, as visitors will not be compelled to travel five miles in a stage coach, as they do if desirous of visiting the Mammoth Cave, which is five miles from this town. In fact all the celebrated caves of Kentucky are in this immediate vicinity. The surface is very much broken, full of great elevations and depressions, with everything to indicate that there were volcanic eruptions or violent upheavals of the earth at some period.

The newly discovered cave has been named the Grand Crystal Cave, and is as beautiful as its name implies. Ladders and bridges are being constructed, and Mr. J. R. Puckett, a capitalist of the town, announces his intention of having a small steamboat constructed expressly for the purpose of navigating its wonderful rivers.—*Cincinnati Commercial.*

Longevity of the Horse.

At Rochester, in this county, there died on the 12th of September the oldest horse on record for a number of years. He was the property of the famous Daniel D. Bell, of legal as well as gold mine notoriety. He was known by the name of "Gumbo," and in his day was a noted stallion. Many citizens of Kingston and of Ulster county remember the animal as a splendid horse when they were boys. At the time of his death he had attained the ripe age of forty-five years and six months. He retained a remarkable vitality to the last, and for three quarters of an hour before his demise he stood upon his legs, proud and majestic, as in his younger days. He had long been the property of Bell, who had driven him many thousands of miles in his lifetime, he having owned him a period of twenty-seven years and a half, since he was eighteen years old. If anybody can beat this, let him speak out.—*Rondout* (N. Y.) *Courier.*

To make Corks Air-tight and Water-tight.

A German chemical journal commends the use of paraffine as the best method of making porous corks gas-tight and water-tight. Allow the corks to remain for about five minutes beneath the surface of melted paraffine in a suitable vessel, the corks being held down either by a perforated lid, wire screen, or similar device. Corks thus prepared, the writer says, can be easily cut and bored, have a perfectly smooth exterior, may be introduced and removed from the neck of a flask with ease, and make a perfect seal.

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New Inventions.

An improved Device for Attaching and Supporting the Ends of a Spring Bed Bottom, and for adjusting the tension of each separate spring, has recently been patented by Mr. Hiram Pitcher, of Fond du Lac, Wis.

Mr. John S. Henshaw, of Goshen, Ky., has recently patented an improved Gate, which is so constructed that it may be opened and closed by a person in a vehicle or upon horseback, with as much facility as when on foot. It can be used as any ordinary gate in case of any mishap to the self-opening arrangement, and will fasten itself securely when shut, and retain its place when opened.

Mr. James W. T. Cadett, of Surrey County, England, has patented an improved Pneumatic Arrangement for facilitating the uncapping or exposing and capping or shutting the lenses of photographic apparatus. The apparatus has a box, which contains a bellows, acted on by a spring, and provided with a pipe opening into the pneumatic tubing. On a spindle acted by the said bellows is secured a shutter, which projects beyond the box. By pressing an air bulb in communication with the tubing, the bellows is actuated, and the shutter or cap is moved, so as to uncap or expose the lens, as required.

Mr. Freeman F. Reynolds, of Villa Rica, Ga., has patented an improved Washing Machine, having several novel features. It is constructed so as to wash the clothes quickly and thoroughly, and without injury.

An improved Saddle Stirrup has been patented by Mr. John M. Freeman, of Parkersburg, Ind. This invention consists in connecting the loop of the stirrup strap to the stirrup by a pin on one end of a swinging plate, which plate is pivoted at the inside of the stirrup in such position that it will be moved by the foot of the rider when the foot is bent, as it would be in case of accident.

Mr. Mercer Hemmingway, of Owensborough, Ky., has patented an improved Medical Compound for the prevention and cure of hog cholera.

Mr. Cornelius Young, of Sandy Hill, N. Y., has devised an improved Roll Suction Box for Paper Making Machines, which consists in the combination of the troughs with the rubber rollers and the sides of the suction box to form water seals for the said rollers, and in the combination of the hard rubber pulleys or wheels with the adjustable partitions of the suction box, and with the cross strips and the rubber rollers to assist in carrying the wire cloth.

A novel Drill Tooth Attachment has been patented by Mr. Silas Frank, of Hagerstown, Md. This is an improvement in the class of seeding machines whose boots or drill teeth are pivoted to the drag bars and have a spring attachment, which allows them to yield or assume an oblique position whenever the point of the tooth encounters an unyielding obstacle.

A National Law Governing Adulteration Needed.

We are glad to see that the subject of adulterating articles of food and drugs is attracting the attention of our newspapers as well as that of the public. The New York *Grocer* and the *Grocer and Country Merchant*, of San Francisco, have both opened their columns to the evils of adulteration, and the former journal calls for national legislation on the subject, and suggests that the time is a favorable one to direct public attention to its importance, to prevent or regulate the adulteration of foods and drugs, and providing the necessary machinery for its enforcement. The most advanced and enlightened nations have found it necessary to enact such laws, and have succeeded in enforcing them to a very satisfactory extent. In this country individual States have attempted to legislate upon the subject, and have in almost every instance failed to accomplish good results. On the contrary, they have only succeeded in making discriminations against their own citizens that have, or might have, accrued to the benefit of those of other States. If a sugar refiner in New York city is permitted to use adulterants with impunity, while one in Jersey City is prohibited from doing so, simply because he is in a different State, the discrimination might be disastrous to sugar refining in New Jersey. A law to be practical must be national. The power to enact such a law is as clearly contained in the clause of the Constitution "to regulate commerce between the States," as is that to govern transportation. The necessity for its exercise, we think, is manifest to all who have given attention to the subject. On every side may be found adulterated food products and drugs. Only within the last month the adulteration of sugars and sirups has attracted unusual attention. The extent to which milk is adulterated is one of the most flagrant impositions upon the consuming public. Coffees and spices have long been favorite articles for the adulterator's art. Even the product of the busy bee is now sophisticated to such an extent as to multiply the yield to such proportions as would exhaust the honey of the entire vegetable world and utterly appal this most industrious of all insects. There is some hope in a more conscientious public opinion, but there is no power so quick to develop that public opinion as the strong arm of the law. We would not follow fully the English or Canadian laws, but a modification of them might be made to suit our requirements. We believe the sooner we come to adopt such a law the sooner will this flood tide of adulterated trash be stayed. It is a fallacy to say that the people demand these cheap and nasty goods. It is a mistake to suppose that a poor man wants poor things to eat or adulterated drugs to use, and it is a libel on the people to say so.

THE NATIONAL ACADEMY OF SCIENCES.

The fall meeting of the National Academy of Sciences was in session in the chapel of Columbia College, this city, during the four days ending November 8. This, unlike the spring meeting, which is always held at Washington, was devoted almost exclusively to scientific work; the exceptions falling on the morning sessions of the first and second days, when at government request, the claims of the three rival exploring parties in the Western Territories were under investigation, in order to determine the best methods of securing the thorough economical survey of those regions. The session was secret, and the results will not be made public until the report of the association has been submitted to the authorities at Washington. Professor O. C. Marsh, vice president, occupied the chair, made vacant by the death of Professor Henry.

The first paper was read by Dr. Henry Draper, on "The Solar Eclipse of July 27, 1878," the results of which have already been laid before our readers. The next paper, on "The Early Types of Insects," was read by Professor Samuel H. Scudder; a technical review of the course of development in the insect world, arriving at the conclusion that the laws of succession of the insect tribes are similar to those long known to hold in other groups of the animal kingdom, and that the facts obtained by observation are in the main such as the theory of descent demands. Professor Charles S. Peirce followed with an address "On the Acceleration of Gravity at Initial Stations."

The second day Professor William P. Trowbridge discussed the inapplicability of the old theory of the turbine water wheel to the newer constructions instituted by Boyden and Francis. While the newer constructions of these inventors had gone into use, the old methods were still described by Weisbach, Rankine, and others, and with these the student was alone familiar. Professor Trowbridge described the three classes of turbine wheels, and deduced formulas applicable to these classes by which the maximum of efficiency and velocity could be gained. He characterized the plan of the wheel obtained by Francis, and now in general use, as one of those happy intuitions by which practical scientific men, in this country especially, have accomplished such remarkable results.

General Henry L. Abbot described his method of securing instantaneous photographs of torpedo explosions, and discussed the value of photography in the study of instantaneous phenomena. Professor Alexander Agassiz followed with an account of the embryology of the gar pike, his observations leading him to the belief that this fish does not differ in its development from bony fishes generally, as naturalists had been led to think. He also described the arrangement of his Zoological Marine Laboratory at Newport, R. I. Thus far it has been more successful than his father's more ambitious attempt at Penikese Island. Professor Stephen Alexander, of Princeton, closed the day's proceedings with a proposed demonstration of the eleventh axiom of Euclid.

The third day's scientific work began with another mathematical paper by Benjamin Alvord, Paymaster General, U. S. A., on the "Intersection of Circles and the Intersection of Spheres." Of more general interest were the observations of Mr. George Davidson, Astronomer in charge of the United States Survey of the Pacific Coast, on "Instruments of Precision at the Paris Exhibition." These observations were made under difficulties, since, both at the manufactories and at the Exhibition, no careful examination of work was permitted him. In summing up his conclusions, Mr. Davidson said that while he saw much of deep interest at the Exhibition, there was no single instrument that he would recommend for imitation. "What he principally learned was what not to copy, and he was convinced that we do not need to go to Europe for such instruments. Our own observers and mechanicians working in harmony are thoroughly competent to lead in the scientific race, for both appreciate the fundamental ideas of simplicity—fewness of parts, harmony of proportion in the accuracy of division and level, adequacy of optical power, and mathematical precision in the bearing of the moving parts."

In the afternoon, Prof. O. N. Rood, of Columbia, described his attempts to obtain a quantitative analysis of white light. In the subsequent discussion, Professor Peirce said that the observations of Professor Rood opened up a new branch of physics, and promised wonderful developments. Heretofore the science dealt only with rude methods of comparison. In this branch there was a departure to new and delicate methods—some, in fact, being among the most delicate known to physical science.

Professor Alexander gave a recapitulation of some of his views on the origin of the forms and present state of many of the clusters of stars, and several of the nebulæ, the source of solar heat, and the drift of the stars. Prof. J. S. Newberry discussed several mooted points in geology; and Prof. E. D. Cope, "The Character of the Theramorphous Reptiles." For the fourth day's work—in progress as this goes to press—the programme announces papers by Professors Cope, Alexander, and Guyot.

How to Get Pure Teas.

A delegation of Baltimore tea merchants lately had an interview with the Chinese embassy at Washington, chiefly with reference to the introduction of pure teas from China, to supplant in American markets those which are colored or adulterated. The Minister said through his interpreter that the various brands of tea sold in America and Europe are unknown to and not used by the tea consumer in China. They are specially prepared by the Chinese tea exporters for the foreign market. They are colored by the use of chemicals; and the process, together with the peculiar methods of fixing up tea for foreign markets, not only renders the plant less palatable and beneficial, but more expensive. The adulteration and coloring of teas for the foreign market, he said, are wholly in consequence of the demand which has existed for such teas; and the Minister expressed the opinion that if Boards of Trade in New York and China would make known the fact that pure teas are not only better but cheaper, it would benefit both producer and consumer. There is, he said, really only one kind of tea plant, and from this both the green and black teas are produced. The equivalents for the two terms "green" and "black" do not signify to the Chinese the color of the tea, as in America, but have reference to the period of gathering, "green" indicating to them, as in "green corn," not a color, but a state of immaturity.

Yung Wing, who has traveled extensively in the tea districts of China, said, in answer to an inquiry, that he saw no reason, except the want of Chinese labor, why tea could not be profitably grown in America, but that it is wholly a question of labor. Chinamen are employed even in Japan to superintend the work of culture and preparation, and would be a necessary part of the same work here. Expert Chinamen would, however, not come to America as long as the present outcry against them is maintained on the Pacific coast.

New Mechanical Inventions.

An improvement in Valves has been patented by Mr. John Patterson, of Salem, Mass. The object of this invention is to furnish an improved valve for attachment to water and steam pipes, so constructed as to prevent leakage. It consists in two or more valves formed or secured to a common valve stem and fitted to valve seats in a globe or shell.

An improved Machine for Paring Peaches, which is simple, convenient, and effective, has recently been patented by Mr. William S. Plummer, of East Portland, Oregon.

Mr. Willis L. Barnes, of Charlestown, Ind., has invented an improved Ballot Box, which is so constructed that the mechanism can be operated only when a ballot has been placed upon the receiving fingers, and, when operated, will deposit the ballot in the box, close the box, register the ballot, and sound an alarm.

Mr. Elon A. Marsh, of Battle Creek, Mich., has patented an improved Lathe for Turning Regular Forms, the novel feature of which consists in a cylindrical bed, and a head stock, tail stock, and rest adapted to the bed.

A Machine for Skivring or Chamfering the Edges of Leather, particularly counters for boots and shoes, has been patented by Mr. Morton M. Clough, of Marlborough, Mass. The invention consists in an adjustable elastic bed, carrying a stationary knife, against which the leather is forced by a feed roller above the bed.

An improvement in Cotton Gins has been patented by Mr. James B. Hull, of Live Oak, Fla. This invention relates to a novel construction of cotton gin specially applicable to ginning sea island cotton having a long fiber. The chief features of novelty consist in the construction and arrangement of a guard plate with respect to the brush, the roller, and the chute, for separating the dust brushed off the roller from the lint.

An improvement in Keys for Musical String Instruments has been patented by Mr. Ferdinand Z. Nicolier, of New York City. This is an improved key for musical string instruments, which facilitates the tuning of the strings and retains them at any desired tension. The invention consists of an inclosing sleeve, secured permanently to the finger board, and having a recessed key spindle, with strong steel springs placed sidewise, so as to bear on the inner surface of the sleeve and produce the retention of the key in fixed position.

Messrs. Louis Prenot and George Marchal, of New York City, have patented an improved Machine for Forming Wooden Heels for Boots and Shoes, which is so constructed as to form the heels rapidly and accurately. It is quite simple in construction.

An improved Machine for Granulating or Cutting Grain, such as oats, wheat, barley, corn, etc., has been patented by Messrs. William Eberhard and Robert Turner, of Akron, Ohio. It is simple in construction, convenient, and effective, doing its work rapidly and well.

An improvement in Combing Machines has been patented by Messrs. Thomas H. Rushton and James MacQueen, of Bolton, England. This patent covers improvements upon the combing machines for which letters patent were granted in England to Josué Heilmann, on the 25th day of February, 1846, No. 11,103. It consists in improved machinery for imparting the requisite advancing and retrograde motions to the detaching and piecing rollers; also in a novel form of nipping apparatus.

An improvement in Sewing Machines has been patented by Mr. Louis Evans, of Pittsburg, Pa., of that class which have a double pointed shuttle, and are adapted to sew either backward or forward by a simple reversal of the machine. It consists in the peculiar construction and arrangement of the feed devices, the shuttle, and other parts, which cannot be properly described without an engraving.

An improvement in Treadle Powers, designed to utilize the full effective force of the body in a treadle movement, has been patented by Mr. Isaac M. Rhodes, of Hancock, Mich.

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TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly. the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN. which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Vertical Engines, 10 to 15 H. P., thoroughly well made. John Hartrick & Co., 47 Gold street. New York.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister, Mf. Optician, 49 Nassau St., N.Y.

Jarvis Patent Boiler Setting burns wet peat, screenings without blast. A.F.Upton, Agent, 48 Congress St., Boston, Mass.

Padlock.—Valuable patent just issued for sale. See advertisement, page 333.

Valuable Patent for sale.—See Protractor illustrated in SCIENTIFIC AMERICAN of October 26. F. L. Cook, Fairfield, Iowa.

1-16 to 1-8 Steel Figures, $1.00; Alphabets, 3.00. S. M. York, Cleveland, O.

Now is the best time to paint, and the best and most economical materials to use are H. W. Johns' Asbestos Liquid Paints, which are prepared in sixteen newest shades and standard colors.

The Young America Scroll Saw beats the world.

Interstate and International Mechanical Exchange. Explanatory circular free. A. S. Gear, Manager, 20 E. 13th St., N. Y., U. S. A.

Engine Lathes, 8 ft. bed, 19 in. swing, on hand and finishing; price low. F.C.& A.E.Rowland, N. Haven, Ct.

Steam, Water, Gas, Valves, Hydrants. Prices reduced, Send for catalogue. Chapman Valve M'f. Co., Boston.

2d hand Steam Yacht wanted. Box 6, Gardenville, N.Y.

Oswego Starch Factory, October 28, 1878. H. W. Johns—Dear Sir: . . . We have several acres of your Asbestos Roofing on our buildings; the first roof put on fifteen years ago is in good condition, and for our business we prefer it to any other. You will please send us at once sufficient to cover twenty-eight squares. Yours respectfully, T. Kingsford & Sons.

The Goddard Emery Wheel. Best, strongest, and cheapest. Satisfaction guaranteed. E. A. Goddard, General Sales Agent, also dealer in Machinists' Supplies, 176 Fulton St., N. Y. city. Send for catalogue.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are to be sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

13 in. Surface Gauge, $2.00. S. M. York, Cleveland, O.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

Rubber Hose, Steam Hose, Suction Hose, Linen Hose, Cotton Hose. Greene, Tweed & Co., 18 Park Place, N.Y.

For the best advertising at lowest prices in Scientific, Mechanical, and other Newspapers, write to E. N. Freshman & Bros., Advertising Agents, 186 W. 4th St., Cin., O.

Valuable Patent for Shooting Target for sale. Recently patented. Address Wm. Kuehn, 499 Spring St., Buffalo, N. Y.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

The Lawrence Engine is the best. See ad. page 333.

For the most substantial Wood-Working Tools, address E. & F. Gleason, 52 Canal St., Philadelphia, Pa.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Alcott's Turbine received the Centennial Medal.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Wanted.—Articles to manuf. D.J.Miller, Mohawk, N.Y.

Fine Gray Iron Castings a specialty, also Wire Workers' Pickets and Rosetts in stock. A. Winterburn's Foundry, 16 De Witt St., Albany, N. Y.

Kreider, Campbell & Co., 1030 Germantown Ave., Phila., Pa., contractors for mills for all kinds of grinding.

Latest and best Books on Steam Engineering. Send stamp for catalogue. F. Keppy, Bridgeport, Conn.

The only Engine in the market attached to boiler having cold bearings. F.F.& A.B.Landis, Lancaster, Pa.

The SCIENTIFIC AMERICAN Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

For Power&Economy, Alcott's Turbine, Mt.Holly, N.J.

Books for Engineers and Machinists. Catalogues free. E. & F. N. Spon, 446 Broome St., N. Y.

Northrop's Sheet Iron Roofing makes most durable fireproof roof. Used on all kinds of buildings. Send for circular and prices. Northrop & Co., Pittsburgh, Pa.

H. Prentiss & Co., 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J. English Agency, 18 Caroline St., Birmingham.

Vertical & Yacht Engines. N.W.Twiss, New Haven, Ct.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Eagle Anvils, 9 cents per pound. Fully warranted.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

North's Lathe Dog. 347 N. 4th St., Philadelphia, Pa.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See advertisement.

Baxter Wrenches, Blake's Belt Studs, Soap Stone Packing, Empire Packing. Greene, Tweed & Co., 18 Park Place, N. Y.

Warranted best and cheapest Planers, Jointers, Universal Woodworkers, Band and Scroll Saws, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

Wheel Press, Cotton Press, Pipe Line, and Test Mercury Gauges. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

Dead Pulleys, that stop the running of Loose Pulleys and Belts, taking the strain from Line Shaft when Machine is not in use. Taper Sleeve Pulley Works, Erie, Pa.

NEW BOOKS AND PUBLICATIONS.

ESSAYS IN PHONETICS:

1. ECLECTIC SHORT-HAND. A new system adapted to general use and to verbatim reporting. By J. Geo. Cross, A.M. Chicago: S. C. Griggs & Co. 12mo. pp. 304. $2.
2. *The Kirographer and Stenographer.* A quarterly magazine devoted to reform in Orthography, Chirography, Stenography, Language, Education, and kindred arts and sciences. Amherst, Mass.: J. B. & E. G. Smith. Price $1.
3. PHONOGRAPHY MADE EASY, after the French System Stenographie-Duployé. By J. A. Manseau. Montreal: Beauchemin & Valois. 24mo. pp. 110.

These various efforts to provide for English writers an acceptable substitute for ordinary long hand would seem to imply either a superabundant desire for laborious invention, or else a practical failure of existing systems of rapid writing. There can be no question that each and all of the various modifications of Pitman's phonography, and tachygraphy as well, will meet the requirements of professional stenographers admirably. But not one of them comes anywhere near meeting the everyday demands of ordinary writers. They are altogether too complicated, too hard to learn and remember; and, as none of them affords a practical method for the complete expression of English speech, it is not at all surprising that they fail to win any large degree of popularity.

Mr. Cross's new system differs from phonography in that it makes no pretense of being phonetic. He simply transliterates ordinary writing by substituting simple strokes for the letters in use. He claims another advantage in that he bases his alphabet on straight lines and (for the most part unshaded) portions of the ellipse, the easiest possible strokes to make. With short words the writing looks simple and easy; but for ordinary polysyllables a great number of contractions have to be introduced. As a stenographic system it appears to be facile and rapid, though it does not impress one as being as legible as it might be.

Mr. Brown's system has more of the look of tachygraphy. He uses no shaded strokes; has a phonetic alphabet; expresses vowel sounds cursively; and employs a multitude of stenographic hooks and crooks. Very many of the longer words look like snarls of spider-web; yet his disciples pronounce the writing easy and legible. With short words the writing appears graceful and fluent.

Mr. Manseau's system is an adaptation to English of a phonetic system used in France and other European countries. It is less complicated by stenographic features—that is, is more alphabetic—than Pitman's phonography, and most of the vowels may be inserted in the order of speech. Its alphabet is formed of light curves and dashes, short and long, plain and crossed, with diacritic marks to show vowel differences. Since three motions are required to make a dash, cross it, and return, nearly half of Mr. Manseau's characters take the time of three strokes, making the time and labor of writing much greater than the writing indicates at first sight. The writing looks also as though it would be less easy to execute than any of the short-hand systems now in use in this country.

Notes & Queries

(1) G. A. B. asks: 1. What would be the pressure in lbs. from ⅛ inch jet from a ⅛ inch pipe 10 feet long from a barrel of water? A. The pressure per square inch will be about 0·433 lb. for each foot in height. 2. How long would it take for the water to run out of 32 gallon barrel from 10 feet head from ⅛ inch hole? A. The theoretical velocity of discharge is

$$8{\cdot}02 \times \sqrt{\text{head in feet.}}$$

The actual velocity is about 60 per cent of this, for a jet of the ordinary form.

(2) S. H. R.—Carbon is not perceptibly expanded by the passage of such an electrical current as is usually employed with the microphone.

(3) E. S. C. asks: 1. What kind of a water wheel will be best for an 8 foot fall of water running 4 cubic feet per minute? A. A small turbine. 2. Can I get power enough from such a fall and wheel to work a half barrel churn or a small wood lathe? A. We think not.

(4) R. M. T. asks: What is the best work on steam heating by radiation? A. Schumann's "Manual of Heating and Ventilation" is one of the most recent and reliable works on the subject.

(5) J. G. B. writes: Please give me the length of stroke for a small engine of 2 inch bore, the weight of a flywheel for same, and the length of the various rods connected therewith, also the size of the boiler for the same, and the number of tubes there should be in it. A. Stroke, 3 inches; connecting rod, 7½ inches; flywheel, 30 lbs.; boiler, 15 inches diameter, 30 inches high, 1¼ inch tubes, at spaces of not less than ¾ inch from each other.

(6) T. L. McG.—For experimental purposes we would recommend the Fuller battery or the modified form of Bunsen's known as the carbon battery. The electro-motive force of the gravity is about half that of Grove's or Bunsen's.

(7) C. J. M. asks how to complete a local circuit by the vibration of a telephone diaphragm. A. We do not think it can be done.

(8) C. E. G. asks: Will a boiler 16 x 30 inches be large enough to furnish steam for an engine 3 x 4 inches, and how fast will it drive a boat 20 feet long with a propeller 20 inches in diameter? The boiler has 20 feet heating surface, and carries 100 lbs. steam to the square inch. A. You might obtain a speed of 5 or 6 miles an hour in smooth water.

(9) J. E. S. asks: How may cotton fabric be economically rendered waterproof and strengthened? A. Saturate the goods with a strong hot aqueous solution of good resin soap, and then wring, transfer, and digest them in a second bath of alum or aluminum sulphate or acetate dissolved in hot water. Rinse and dry thoroughly at a temperature of about 80° Fah. Thus treated the fibers do not readily absorb water, but the goods are not actually waterproof.

(10) Constant Reader asks: 1. What is the difference between crown and flint glass? Of what is the best glass for optical instruments composed? A. Crown glass is prepared by fusing sand with carbonate of potash and chalk. Flint glass is a double silicate of potash and oxide of lead. 2. Can the object glass of a telescope, say 2 or 3 inches in diameter, be formed in a single piece, so as to give a good view of a distant object? A. No. 3. Is there any common article of manufacture in which the glass used is of a quality fine enough to be used for manufacturing an object glass? A. No. 4. I have a large quantity of broken glass, consisting of chemical retorts, test tubes, lamp chimneys, watch crystals, etc., and I would like to know if any of them could be used alone, or by mixing with some other substance, to produce glass of sufficient quality? A. We think not. 5. If I was to use glass free from blemishes, could I in moulding it produce an article also free from blemishes? A. Probably not. 6. Can a good lens be made by moulding the glass of the form desired and then polish on a lathe? A. No. 7. Can the proper form of the lens be obtained by taking an impression of a lens of the dimensions of the one required, so as to form a mould for the glass? How and with what could such an impression be taken of both sides, so as to form a correct mould? A. This would be impracticable. 8. If a lens cannot be produced in this way and from the glass mentioned above, of a sufficient quality for a telescope, would it be suitable for a burning glass? A. Possibly.

(11) C. B. writes: I have a 10 horse horizontal boiler, which I use sometimes steadily and sometimes only occasionally. It may stand 6 weeks or two months without being fired up. Will it rust out under such circumstances, or should the water be let off whenever it is to lie still? A. If you cannot keep it perfectly dry when not in use, leave it full of water.

(12) S. B. E. writes: I have made a Ruhmkorff induction coil, and for the size it should give more of a spark at a greater distance than it does. Will you tell me the trouble? The primary coil is composed of about 400 feet of No. 22 copper wire, and the secondary of about 1800 feet of No. 30, insulated with cotton. Does the battery used make any difference, and which kind is the best for operating a coil? The core is about ¾ inch in diameter. I have made every part carefully, and it is a beautiful looking instrument. A. You do not state whether you have a condenser. This is very necessary to the successful working of the coil. Your primary coil would be better if made of two layers of No. 16 wire. It is probable that the insulation is defective. The primary coil should be separated from the secondary by several thicknesses of paper coated with melted rosin, to which a small quantity of beeswax has been added to render it somewhat flexible. The several layers of the secondary should be separated in the same way, and it would add to the efficiency of the coil if the layers of the secondary were covered with the rosin. Use a Bunsen battery.

(13) G. F. P. asks: Can a telephone be worked successfully 20 or 30 miles, with instruments at each end of the wire only? A. Yes.

(14) J. E. S. W. asks how to make an acoustic telephone. A. See p. 75, current volume, query 28.

(15) E. K. asks: What size should a blower be for a force blast for a cupola, 5 in. in diameter and 12 in. high, to the top of the brick, and at what speed should it be driven? A. A small piston blower would be preferable to a rotary.

Where is Knight's "Mechanical Dictionary" published, where can I get it, and what is the price? A. You can obtain it from any of the booksellers who advertise in our columns.

(16) J. S. C. writes: I am running a nest of six boilers, size 4 x 24 inches; have painted the breeching and pipes with asphaltum, but it burns off the breeching. What can I paint with that will stand the heat? A. Black varnish, made from petroleum, will probably answer your purpose.

(17) R. F. asks: Can you tell us how steam boilers are welded? A. Short lengths are welded at a time, with a portable furnace.

(18) F. H. C. asks: At what speed can the piston of a hydraulic engine be run without appreciable pound, with 50 lbs. water pressure? The question supposes a well arranged and proportioned valve motion. A. In the case supposed, we think it could have piston speed equal to that of a good steam engine.

(19) F. H. S. asks: 1. What is the proper or best length of focus for a 6 inch telescopic speculum, and what should be the length of tube? A. Make the focal length ten, and the tube eleven times the diameter. 2. Where and by whom could I get my speculum silvered, and what would be the approximate cost? A. You can find in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 105, information which will enable you to silver your own speculum. 3. What would be the cost of an eyepiece of good power already set with necessary length of sliding tubes for adjustment of focus? A. Address any of the opticians who advertise in our columns.

(20) F. P. asks if two permanent bar magnets can be so arranged as to produce current enough to start a pretty good induction coil upon the closing of the circuit, without the aid of any battery, or if they could be made to ring a small electric bell. A. If the bar magnets are very strong you might obtain a current from them by rapidly revolving opposite their poles an electro-magnet wound with fine wire. An induced current cannot be produced by means of permanent magnets without moving either the magnets or the coils in which the current is generated. 2. Is there any battery that will work good in cold weather and not eat the zincs too fast (until the connection is made) and yet will operate an electric bell or induction coil? In fact, a cheap battery, not costing over $5. A. Yes. A Leclanché or Fuller battery will answer, but they must not be subjected to a freezing temperature.

(21) D. B. W. writes: We have a telephone line 3 miles long. Could a telegraph instrument be attached and operated for a call bell? A. Yes, on a closed circuit. 2. Is there a call bell in the market that could be bought for $3 or $4? A. Yes.

Would a lightning rod be any advantage to a building where there is nothing to connect with but the earth? A. Yes; bury a barrel or so tin or iron scrap—or better still, a few large sheets of copper—in earth that is always moist, and connect the rods with them.

(22) J. P. S.—There are many rotary pumps in the market that are quite as durable as piston pumps.

(23) W. A. O. asks how button and comb makers soften horn so that it is soft and pliable to work. A. It is softened by immersing it for a short time in boiling water.

(24) K. J. D. asks how to make skeleton ferns or leaves. A. Place them, with a trace of yeast, in a little rain water, and allow the fermentation to proceed until the membranous portions become soft and easily washed away in a stream of water. They are bleached by dipping for a few minutes in a strong aqueous solution of sulphurous acid gas, or exposing them (while moist) in a box filled with the vapor of burning sulphur.

(25) C. R. asks: How can I make a cheap call bell to work on a telephone line of 300 feet without a battery? A. Perhaps you can jingle a bell by pulling the wire if the latter is properly supported.

(26) M. T. asks whether a double cylinder engine, cylinders 2 inches stroke, 1 inch bore, would be large enough to run a sewing machine. If large enough, how should the boiler be made, to heat by kerosene? A. The engines are of sufficient size. Make a vertical boiler 20 inches high, 10 inches diameter, with 18 or 20 1 inch tubes.

(27) A. W. G. asks: By using a breast water wheel, what number of horse power could I obtain from a stream of 2 feet head and 350 cubic feet per minute? What size of breast wheel could I obtain best results from for driving a 30 inch circular saw? A. You may obtain about 60 per cent of the power of the water. Diameter of wheel 3 to 3½ feet.

(28) H. E. B. writes: Please tell me how to make a small horizontal toy steam engine. A. If you will look over our files you will find the information you require about making and managing steam engines. The proportions for small and large engines are the same.

How can I remove India ink from the flesh? A. The knife or cauterization is the only resort.

Will the Great Eastern ever be used again as a passenger boat? A. We have no means of ascertaining the probable future use of the Great Eastern.

(29) C. L. writes: 1. I am about building an icehouse and wish to ask you the following questions: Can I put in a box in the end of the house (opposite the end where the ice is put in), making it airtight from the icehouse proper, with a door opening outside, to use as a refrigerator? A. It is not probable that the arrangement suggested would prove very satisfactory. See Nos. 55, 99, 116, SCIENTIFIC AMERICAN SUPPLEMENT. 2. Will it be necessary to have a ventilator from the refrigerator opening outside? A. Yes. 3. Will it be necessary to have the refrigerator lined, it being made of seasoned pine or spruce boards, which have been painted many years? A. No.

(30) J. K. asks how the mucilage on the U. S. postage stamps is made. A. The mucilage used by the government for postage stamps is said to be made as follows: Gum dextrin, 2 parts; water, 5 parts; acetic

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acid, 1 part; dissolve by aid of heat, and add 1 part spirits of wine.

(31) W. F. A. asks: 1. Is there any way by which a vein of water can be found in the ground before boring or digging, and is there any truth in a vein of water attracting a forked switch, which is so commonly claimed by old fogies throughout the country? A. A knowledge of geology is often of much value in the selection of a site for a well, but water can only be "found" by boring. "Divining rods," etc., are worthless. 2. Where may I obtain an artesian well boring machine? A. See our advertising columns.

(32) R. W. Y. asks for a recipe for tempering steel springs, flat, spiral, etc.; something that would give a pretty fair idea to work on. Can you recommend a work on making and tempering springs. A. To temper steel springs heat them to a cherry red, quench in clean water, and blaze off two or three times. For works on tempering address any of the industrial publishers who advertise in our columns.

(33) J. J. R.—Make your drills of the best quality of tool steel; harden, and do not draw the temper on the extreme edge.

(34) M. M.—The so-called "heat lightning" is considered as nothing more than ordinary lightnings triking across the clouds at such a distance that the thunder cannot reach the ear of the observer.

(35) S. H. C. B. asks how to make an emery strap. A. Coat the strap with a good quality of glue to which a very small quantity of glycerin has been added; then dust on the emery and roll it into the glue.

Can I get a patent on a preparation of medicine? A. A medical compound is patentable if new.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. C. A.—The crystalline substance found in the cave is principally gypsum—calcium sulphate. Used in the manufacture of plaster of Paris, and several cements, by potters, for glazing, etc., and for fertilizing purposes. The earthy substance contains a very notable quantity of potassium nitrate (saltpeter) and a trace of phosphoric acid. The former could probably be economically extracted. This and its value in the natural state as a fertilizer could be determined only by quantitative analysis. —B. R. R.—The red substance consists mainly of fine quartz sand coated with anhydrous iron sesquioxide, to which the bright color is due. It may be freed from the grosser particles by washing. Used extensively as a cheap red pigment and for the adulteration of vermilion, etc. The other sample—ferropyrite—contains no precious metal.—W. A. G.—The box contains fragments of flint, quartz, and limestone. The flint is associated with arragonite and ferropyrite. The budlike fossil is a fragment of the encrinite moniliformis. See answer to E. B., under head of minerals, p. 107, current volume of the SCIENTIFIC AMERICAN.—J. B. —Nos. 1 and 2 are indurated ferruginous clay. No. 3 is soft clay slate. None of them are of much value.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Labor Saving Machinery. By O. H. K.
The Musical Cabinet. By Reader.
Indian Arrow Heads. By J. B., Jr.
Band Saw Machines. By W. S.
Where Does the Day Begin? By A. E. O.
Algol. By F. W.
The Poplar as a Lightning Conductor. By J. H. P.
How to make a String Hammock. By J. W. D.
Joseph Henry. By J. F. G. M.
Vulcan. By C. F.
Guns and Projectiles. By J. H. A.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

September 24, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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English Patents Issued to Americans.

From October 18 to October 22, inclusive.

Apparatus for producing embossed figures.—H. Loewenberg, New York city.
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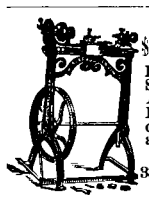

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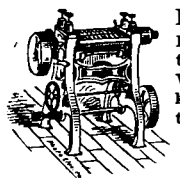

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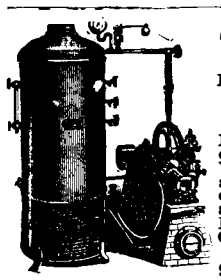

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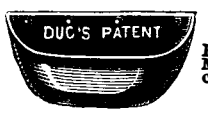

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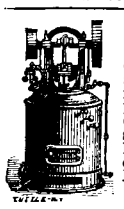

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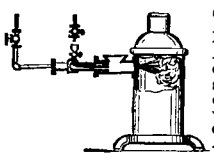

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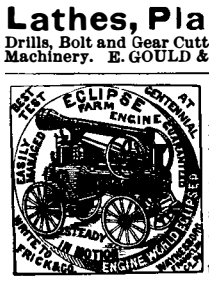

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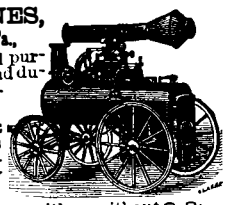

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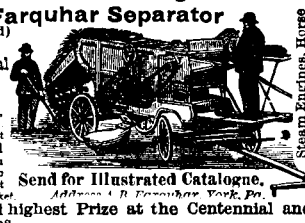

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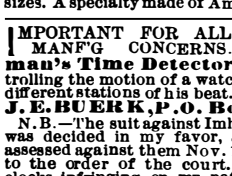

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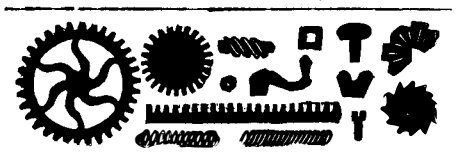

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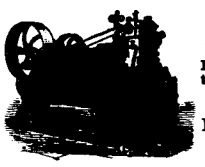

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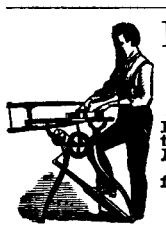

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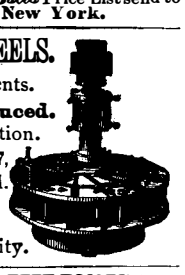

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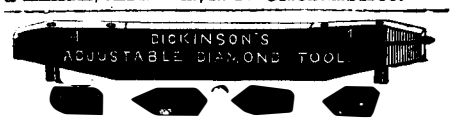

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